DISSERTATION ON

VALIDATING ALVARADO SCORING

IN THE DIAGNOSIS OF ACUTE APPENDICITIS

M.S. DEGREE EXAMINATION

BRANCH-I

GENERAL SURGERY

GOVERNMENT KILPAUK MEDICAL COLLEGE

THE TAMILNADU DR.MGR MEDICAL UNIVERSITY

CHENNAI

APRIL 2014

BONAFIDE CERTIFICATE

This is to certify that this dissertation titled **"VALIDATING ALVARADO SCORING IN THE DIAGNOSIS OF ACUTE APPENDICITIS"** is the bonafide record work done by **Dr. S.I.MOHAMMED SIKKANDER BASHA,** submitted as partial fulfillment for the requirements of **M.S. Degree Examinations Branch I, General Surgery, April 2014.**

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DECLARATION

I, Dr. S.I.MOHAMMED SIKKANDER BASHA, solemnly declare that the dissertation submitted on the topic ***"VALIDATING ALVARADO SCORING IN THE DIAGNOSIS OF ACUTE APPENDICITIS"*** is a bonafide work done by me from Jan 2013 to December 2013, towards partial fulfillment of the requirements of M.S Degree examinations, General Surgery, April 2014.

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ACKNOWLEDGEMENT

I sincerely thank Prof.P.Ramakrishnan MD, DLO, the Dean, Kilpauk Medical College for granting me permission to carry out and successfully complete my dissertation work. I consider it a privilege to have done this study under the supervision and guidance of Prof.R.Kannan M.S, who was a constant source of inspiration and guidance.

Am indebted to Prof R.A.Pandyaraj MS,FRCS , Prof.R.V.Suresh MS , Prof. Affee Asma MS,DGO and Prof.V.Sathish ,M.S, for helping me through the process of completing my dissertation. Their invaluable advice has helped me complete the study on time.

I would also like to thank Dr. Rosy Adhaline Selvi MS, DGO, Dr.Princess Beulah MS, for their valuable support and encouragement throughout the period of study. I would like to thank all my colleagues Dr.Ahila, Dr.Vinodh , Dr. Abilash , Dr.Varun , Dr.Geetha , and the house surgeons Dr.Siddharthan , Dr.Sivaraman who were instrumental in bringing up this study.

I would like to thank my senior fellow postgraduates for their suggestions and ideas and finally I would like to thank our patients for their gratitude and co-operation in this study.

LIST OF ABBREVATIONS USED

D.D.	-	Differential Diagnosis
HPE	-	Histopathological Examination
USG	-	Ultra Sound
WBC	-	White Blood Cells
RIF	-	Right iliac fossa
NMR	-	Nuclear Magnetic resonance
Hb	-	Haemoglobin
TLC	-	Total leucocyte count
DLC	-	Differential leucocyte count.
PID	-	Pelvic inflammatory disease.
CT	-	Computerised Tomography

ABSTRACT

Introduction:

Acute Appendicitis is a common and sometimes confusing cause of acute abdomen at all age groups. Diagnosis of appendicitis can be difficult, occasionally taxing the diagnostic skills of even the most experienced surgeon. Despite increased use of USG, CT, the rate of misdiagnosis of appendicitis has remained the same (15.3%).

Objectives:

To review the usefulness of Alvarado score & to evaluate its feasibility and value as an aid in surgical decision making and to reduce the number of negative laparotomies.

Materials and Methods:

100 patients who were admitted to Government Royapettah Hospital from Jan 2013 to Dec 2013 with clinical suspicions of acute appendicitis were included in the study. The modified scoring system is based on 3 signs, 3 symptoms and 1 laboratory finding. The patient was classified as males, females and children (< 12 years). These were further grouped based on the scores 7 - 9, 5-6 and <5.

Observation & Results:

In our study 52 were males,

38 Females,

10 Children

Males with score 7-9 were 39

Females with score 7-9 were 14

Children with score 7-9 were 10

Males with score 5-6 were 08

Females score 5-6 were 18

Children Score 5-6 were 0

A total of 80 patients with score of 7-9 and 5-6 were operated. Among males with score of 7-9, 35 patients were operated and 34 were found to have inflamed appendix.

Females with score 7-9, 16 were operated and 11 were found to have inflamed appendix.

Conclusion:

Alvarado score significantly reduces the number of negative laparotomies without increasing the overall rate of appendicular perforation. It is very effective in Men & Children but diagnostic laparoscopy or ultrasonography is advised to minimize the high false negative rate in women.

Keywords:

Appendicitis, Negative appendectomy rate, Clinical Score.

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INTRODUCTION

Acute appendicitis is acute inflammation of the appendix. It is a common, sometimes confusing and often treacherous cause of acute abdomen at all age groups. Of all the abdominal emergencies, acute appendicitis heads the list of causes classified under acute abdomen.

It is not surprising that the diseases of appendix do not seem to have a place in areas of active clinical investigation and one finds, relatively few articles dealing with appendicitis. But no one in current surgical practice can deny the fact that appendicitis still represents a large portion of cases and they continue to baffle them by their oft-deceptive presentations and sometimes may cause quite an amount of morbidity and unnecessary mortality.

Acute appendicitis is commonly caused due to a variety of reasons namely difference in dietary habits, food adulterations, indulging in mixed diet habits, seasonal changes particularly colder periods. Acute appendicitis is prevalent among males and females irrespective of age factor but is noted in slightly large numbers among males and rarely found in infancy and old age

The etiology of acute appendicitis is plenty among which obstruction to lumen and infection play an important role.

Of all the infections E.coli is found to be the most common organism, which is responsible for acute appendicitis .

The diagnosis of appendicitis is quiet difficult, occasionally testing the diagnostic skills of even the most experienced surgeon. similarly, the decision making in the management of patients with inflammation or abscess of the appendix can be a task .Patients with appendicitis first recognizes that they have a episode of pain which is unique and then presents to the physician who diagnoses the condition. Delay in diagnosis arise from errors on the part of the patient or physician, and all delays complicate the disease.

The severity of acute appendicitis is in the frequency with the peritoneal cavity which is infected from the same focus, either by perforation or by transmigration of bacteria through the appendiceal wall. The classic triad of a history compatible with acute appendicitis, is pain at the McBurney's point and leucocytosis has diagnostic accuracy rate of less than 80 percent and even after the invention of advanced radiological techniques such as ultrasonography,computed tomography,magnetic resonant imaging or radionuclide scanning are , the accuracy usually does not reach more than or equal to 90 percent.

Patients presenting with acute right iliac fossa pain remain a diagnostic challenge. Acute appendicitis is the most common indication for surgery in these patients. After careful clinical evaluations and observations surgical intervention is undertaken. There is a large geographical variation in the incidence of

appendicitis and the prevalence of diseases that mimic it. Migrating pain, and involuntary guarding and persistence or progression of clinical signs are the main criteria favouring the operation.

The lifetime rate of appendectomy is 12% for males and 25% for females, with almost 7% of the total population undergoing appendectomy for acute appendicitis. The rate of appendectomy has remained constant at 10 per 10000 per year. Appendicitis is almost frequently found in their second to fourth decades of life with a mean age of 31.3 years and a median age of 22 years. There is a mild male to female predominance , M:F 1.2 TO 1.3:1[1,2]

Despite an increased use of ultrasonography, computerized tomographic scanning and laparoscopic techniques, the rate of misdiagnosis of appendicitis has remained constant at a rate of 15.3%, at par with the rate of appendiceal rupture. The rate of misdiagnosis of appendicitis is markedly high among women than men,22.9 to9.3%. The negative appendicectomy rate for women with reproductive age group is 23.2%, with the highest rates identified in women among 40 to 49 years of age. The highest negative appendicectomy rate is reported for a women who was older than 80 years of age.[2,3,4.]

The morbidity and mortality rates associated with acute appendicitis ia markedly increased when perforation ensues, wound infection rates are very high , intra-abdominal abscess formation

increases 15 fold and mortality rate is 50 folds greater. Appendiceal perforation is a rare cause of tubal infertility (Mueller et al 1986).

The topmost priority and the aim of the surgeons should be to avoid perforation at any cost . The cost of which is the high rate of apendicectomy with histologically normal appendix, which is very expensive, and it almost has a complication rate which is not much lower after removal of a pathological appendix (Nase ET al 1980: Arnborgnsson 1985) The surgery for negative appendix is associated with the usual spectrum of immediate post-operative complication in up to 15% of patients (Lewis et al 1975).Some patients may have complications such as small bowel obstruction and incisional hernia.

A scoring system described by Alvarado[5] was formulated to track down the negative rate of appendicectomy with no significant increase in morbidity and mortality.

THE ALVARADO SCORE

Alvarado in 1986 formulated a scoring system for diagnosing acute appendicitis. The scoring system developed by Alvarado has 3 symptoms, 3 signs & 2 laboratory findings.

Table – 1

ALVARADO SCORE	
Symptom's	**SCORE**
Mig RIF Pain	1
Anorexia	1
Nausea/ Vomiting	1
Signs	
Tenderness / RIF	2
Rebound Tenderness RIF	1
Elevated Temperature	1
Laboratory	
Leucocytosis	2
Shift to Left of Neutrophils	1
Total Score	**10**

According to the scoring system, patient who has a score of 1-4 were not considered probably to have acute appendicitis. Those patients who has a score of 5-6 were considered to have a probable diagnosis of acute appendicitis but not convincing enough to advice to undergo immediate surgery and these were marked for further review. Those patients who has a score of 7-8 were considered to have a possible diagnosis of acute appendicitis & those patients who has a score of 9-10 were considered to have an almost definitive diagnosis of appendicitis and posted for surgery. The score can be varying on re-examination. The lab finding of leucocytosis is defined as white cell count in more than of 11,000/mm^3

MODIFIED ALVARADO SCORE :

Alvarado Scoring was modified by M.Kalan, D.Talbat, W.J. Cunliffe and A.J. Righ (1994). The modified Alvarado score excludes one laboratory finding; the left shift to neutrophil maturation. This laboratory parameter was excluded as it was not available on a routine basis in the laboratories. The patients were therefore scored for 9 in contrast to 10 points.

Table – 2

MODIFIED ALVARADO SCORE	
Symptom's	**SCORE**
Mig RIF Pain	1
Anorexia	1
Nausea/ Vomiting	1
Signs	
Tenderness / RIF	2
Rebound Tenderness RIF	1
Elevated Temperature	1
Laboratory	
Leucocytosis	2
Total Score	**9**

Other scoring systems recently introduced for diagnosis of acute appendicitis are OHMANN, ESKELINEN, De-DOMBAL score. The sensitivity and specificity of the OHMANN score in diagnosing acute appendicitis is 63% and 93% the positive predictive value was 77%. The sensitivity and specificity of the ESKELINEN score in the diagnosis of acute appendicitis were 79% and 85%. The positive predictive value was 65%. These scores had different criteria for diagnosis, which make them less feasible in clinical use compared to the Alvarado score.

AIMS AND OBJECTIVES

The aim of this study is to review and validate the use of Alvarado scoring and to evaluate its feasibility and value as an decision-making tool in cases of possible acute appendicitis in reducing the number of negative laparotomies.

In this prospective study, 100 patients with a provisional diagnosis of acute appendicitis admitted to Government Royapettah Hospital, Chennai were studied.

The patients diagnosed to have acute appendicitis in view of end score obtained by modified Alvarado scoring system were either observed or operated according to the cut off point. The results so obtained were studied in relation to the world literature available. Results of operative measures, conservative measures, and histopathological examination were reviewed.

HISTORICAL REVIEW

Review of ancient texts have various descriptions of surgery being done for ailments mimicing like appendicitis,**Claudius Amyand**, draws all credit for performing the first open appendicectomy a surgeon at St Georges hospital in London.He operated on a 11 year old boy in 1736 with scrotal hernia and fecal fistula.Within the hernia sac, He found the appendix perforated by a pin. He successfully removed the appendix and repaired the hernia.[6]

Appendix was not considered as an organ which can cause disease until the end of the 19th century. Royal Academy of medicine in Paris witnessed the first paper presentation,by **Louyer villermay** in 1824 and reported appendicitis on two autopsy specimens and emphasized this condition to be important .

Villermay's work was expounded by **Francois Melier,** a French physician in 1827. He reported 6 autopsy cases of acute appendicitis and was first to suggest the ante mortem recognition of appendicitis[6]. This work was discounted by many physicians of the era, including **Baron Guillaume Dupuytren**.

Dupuytren believed that inflammation of the caecum was the main cause of pathology of the right lower quadrant . The term typhlitis or perityphlitis was used to describe the right lower quadrant inflammation. In 1839 a textbook authored by **Bright and Adisson** titled elements of practical medicine described the symptoms of appendicitis and identified the primary cause of inflammatory process of the right lower quadrant [7]**Reginald Fitz**, a professor of pathologic anatomy at Harvard, is credited for coining the term appendix. His landmark paper definitively identified the appendix as the primary cause of right lower quadrant inflammation[8]. Initial surgical therapy for appendicitis was primarily designed to drain the right lower quadrant abscesses that occurred secondary to appendiceal perforation.

It appears that Hancock made the first surgical treatment of appendicitis or perityphlitis without abscess in 1848. The first published account of appendectomy for appendicitis was by **Kronlein** in1886. **Fergus** in Canada, performed the first elective appendectomy in 1883[6].

The greatest contributor to the advancement in the treatment of appendicitis is **Charles McBurney**. In 1889 , he published his landmark paper in the New York medical journal describing the indications for early laparotomy for the treatment of appendicitis. It is in this paper that he described McBurney's point of maximum tenderness[9]. Mc Burney subsequently published a paper in 1894 describing the incision that bears his name. However, Mc Burney later credited **Mc Arthur** with first describing this incision [10].

Semm is widely credited with performing the first successful laparoscopic appendectomy in 1982[11].The surgical treatment of appendicitis is one of the great public health advancements of the last 150 years. Appendectomy for appendicitis is the most commonly performed emergency in the world. Additionally, appendicitis is a disease of the young, with 40% of the cases occurring in patients between the ages of 10 and 29 years[12]. **Fitz** reported the associated mortality rate of appendicitis to be at least 67% without surgical therapy[8]. Currently, the mortality rate for acute

appendicitis is reported to be less than 1% [13]. In US, more than 2,60,000 appendectomies are performed each year. It is assumed that there is a 15% negative appendicectomy rate and a median life expectancy of 80 years , development of surgical therapy of appendicitis results in saving approximately 8 million lives per year in the US alone.

In 1902, **Sir Frederick Treves** operated upon king Edward III for appendicitis successfully few days before his coronation. It was one of the most famous cases of appendicitis and did much to popularize the operation. An attempt to sterilize the appendiceal stump with chemicals or cautery became popular early and is still employed by some surgeons. Increased understanding of the pathophysiology of peritonitis, fluid resuscitation and antibiotic therapy in the 1940's decreased the mortality rate. In 1910 **Albert Ocshner** and **James Sherren** advocated the conservative line of management for appendicular mass.

In 1965, **Brooke and Keller** described radiologic signs in acute appendicitis on plain X ray abdomen. In 1978 **Gastro** reported 3 examples of pneumoperitonium. **Haker D A** et al described the use of laparoscopy in the diagnosis of acute appendicitis in young women. **Jeffrey** et al gave an account of the role of ultrasound in the diagnosis of acute appendicitis. He studied 250 cases of acute appendicitis and laid down sonographic criteria for diagnosis and

elicited a sonographic Mc Burney's sign of maximum tenderness on probing.

Alvarado A in 1986 described Alvarado scoring as a practical tool for diagnosis of acute appendicitis.

Puylaert in 1986 evaluated 60 patients with acute appendicitis using graded compression with a higher frequency linear array transducer and reported a specificity of 89%.

DEVELOPMENT OF APPENDIX

Appendix develops as an under developed distal end of the caecum in the sixth week of intrauterine life. Appendix develops from the post arterial segment of the midgut, along with caecum, ascending colon and right two third of the transverse colon. Initially a bud called caecal bud arises from the post-arterial segment very near to the apex of the loop. The proximal part of the bud grows rapidly to form the caecum but the distal part remains narrow and forms the appendix.

Subsequently , the lateral or right wall of the caecum grows much more rapidly than the medial wall. Thus the point of attachment of the appendix comes to lie on the postero-medial aspect of the caecum.

The caecum lies just below the liver and the ascending colon cannot be demarcated. Gradually, the caecum descends to the right

iliac fossa and the ascending, transverse and descending parts of the colon become distinct.

In the final stage, the duodenum, ascending colon and the descending colon become retroperitoneal by the fusion of their mesenteries with the posterior abdominal wall. But the mesentery of the small intestine, transverse colon, sigmoid colon and appendix remains.[14,15.]

CONGENITAL VARIATIONS [16]

Congenital agenesis.

Collins collected 57 cases of true agenesis of appendix

Duplication or triplication

In 1968 Tinckler reported on operating on a triple appendix on a 12 months old male chinese child with other congenital anomalies.

Variations in positions.

Wall Bridge classified duplication of vermiform appendix as:

Type A

Single appendix and single caecum exhibiting partial duplication in various degrees

Type B

Single caecum with two appendix. Further divided into:

Type B-1

Bud like - two appendix placed symmetrically on either side of the Bauhin's valve.

Type B-2

Taenia Colic type - one appendix from the usual site, and the other from the caecum above the lining of taenia at varying distance from the first.

Type C

Double caecum each bearing an appendix

VARIATIONS IN POSITION:

- Due to incomplete downward descent of caecum, the appendix may remain in sub hepatic position.
- Due to overgrowth of ascending colon, appendix may sometimes descend down to a pelvic position along the caecum.
- Due to incomplete or non-rotation of the midgut loop, appendix may assume a position on the left side of the abdomen. This may be associated with transposition of viscera.
- Caecum may have a long mesentery and may be mobile. Because of its mobility, appendix may assume a variable position in the abdomen.

ANATOMY [17]

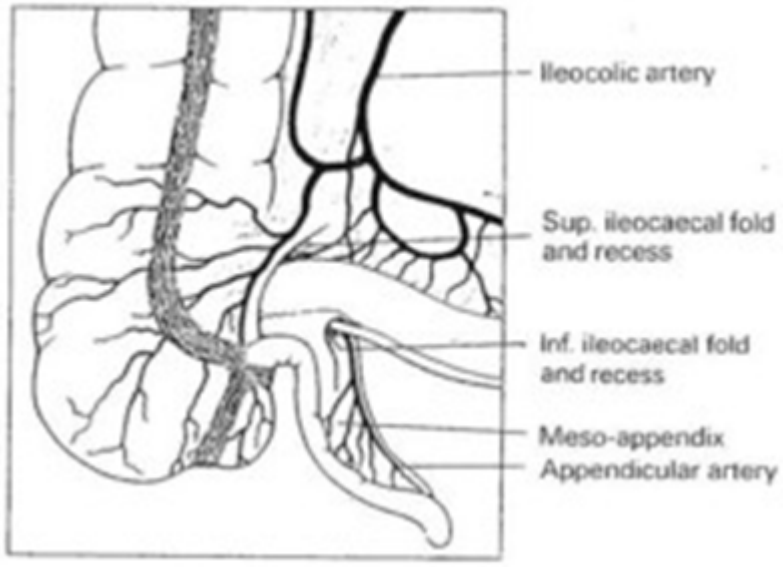


Fig : Anatomy of the Appendix and ileo-caecal region

Vermiform appendix is described as a narrow, vermion (worm-shaped) tube arising from the posteromedial wall of caecum or anywhere below the ileal end.It constantly arises from the site at which the 3 teania coli converge. It has no constant anatomical position. The three taenia coli merge into a complete longitudinal muscle layer over the appendix. The anterior taenia is usually distinct and traceable to the appendix, offering a guide to it.

Appendix differs from 2 -20cm in length, the average length is about 9cm. Appendix being longer in children, may atrophy or reduce in size after middle age.

POSITIONS:

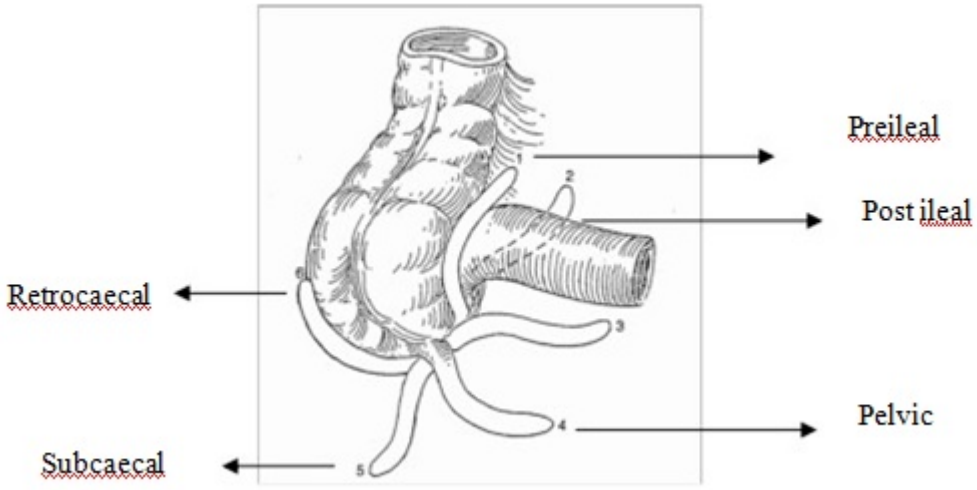


Fig : Various Positions of Appendix

Treves described the following anatomical types comparing the appendix with the face of the clock.

11'O Clock Para colic (lies on the sulcus in the lateral aspect of the caecum).

12'O Clock retrocaecal (lies behind the caecum and may even be totally or partially retrocaecal)

1'O Clock Pre-ileal

2'O Clock Post- ileal

3'O Clock Promontoric (the tip of the organ points towards the promontory of the sacrum)

4'O Clock Pelvic (Appendix dips into the pelvis)

6'O Clock Subcaecal or mid inguinal

Incidence according to Wakely, following a study of 10,000 cases is as follows:

Table - 3 : Positions of Appendix

Retrocaecal	65.28%
Pelvic	30.00%
Subcaecal	2.26%
Pre-ileal	1.00%
Right paracolic , Post-ileal	0.4%
Others	1.06%

MESENTERY OF APPENDIX.

The appendix has a complete peritoneal investment and a small mesentery. This fold is derived from the left leaf of peritoneum and is a continuity of the mesentery. It is triangular in form and is attached along the whole length of the appendix.

BLOOD SUPPLY:

•Arterial:

Appendicular artery is a branch of lower division of the ileocolic artery, runs behind the terminal ileum to enter the mesoappendix a short distance from the appendicular base. Here it gives off a recurrent branch, which anastomoses at the base of the appendix with a branch of the posterior caecal artery.

The terminal part of the main artery lies on the wall of the appendix and may be thrombosed in appendicitis resulting in distal

gangrene or necrosis. Variations are considerable. In nearly 50% of the cases there is an accessory appendicular artery, a branch of posterior caecal artery (after Seshachalam).

•Venous:

Appendicular vein is a radicle of the ileocolic vein. which drains into the portal system.

•Lymphatics:

From the lymphatic follicles through the muscle wall drain into nodes in the mesoappendix. These drain into the paracolic nodes lying along the ileo-colic artery and then to the superior mesenteric group

NERVE SUPPLY:

- **Sympathetic**: Coeliac and superior mesenteric ganglia (T11, T12)
- **Parasympathetic** : Vagus.

Both these nerves form the plexus around the artery supplying the appendix.

PARA- APPENDICEAL FOSSA:

Peritoneal folds near the base of the appendix are sometimes found. Superior ileocaecal recess- opens medially and downwards just above the terminal part of the ileum. It is bounded in front by the vascular fold of the caecum, which contains the anterior caecal vessels, Medially by the medial upper part of the

caecum and ascending colon, Posteriorly by terminal ileum and its mesentery.

Inferior ileocaecal recess opens downwards and medially below the terminal ileum. Its anterior wall is formed by the bloodless fold of Treves extending from the lower border of the ileum to the caecum and anterior surface of the mesoappendix. Its posterior wall is formed by mesoappendix.

Retrocaecal recess.:- lies behind the caecum, bounded anteriorly by the caecum, posteriorly by parietal peritoneum, and on each side by caecal folds of peritoneum.

SURFACE MARKING:

The base of the appendix corresponds to the Mc Burney's point.It is formed by the junction of lateral one-third and medial two - third of the line joining the umbilicus with the anterior superior iliac spine. It is only a surgical approximation with considerable variation.

LUMEN OF THE APENDIX:

It is a small canal which opens into the caecum through an orifice lying below and a slightly behind the ileocaecal opening. A semilunar mucosal fold forming a valve guards the orifice. The appendix is lined by columnar cell intestinal mucosa of colonic type.

Crypts are present but are not numerous. In the base of crypts lie the special cells (kultschizsky cells) , which give, rise to carcinoid tumours, and they can cause appendicitis.

HISTOLOGY[18]

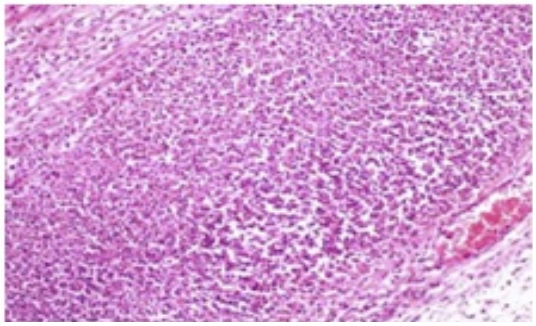


Fig : Histology of Normal Appendix

The structure of the appendix is serosa , muscularis mucosa , sub mucosa , mucosa and lumen.

- **Serosa:** Is a complete covering except along the mesenteric attachment.
- **Muscularis layers :** Longitudinal muscular fibres form a complete uniformly thick layer, except over a few small areas where both muscular layers are deficient leaving serosa and sub mucosa in contact. At the base the longitudinal muscle thickens to form the rudimentary taeniae. The circular muscle fibres form a thicker layer separated by connective tissue.
- **Sub mucosa:** Contains number of lymphoid mass , causing the mucosa to protrude into the lumen, making it a irregular narrowing.

Profused number of lymph tissue has promoted the description of 'abdominal tonsil' for the appendix.

- **Mucosa:** Is covered by columnar epithelial cells and attenuated antigen transporting 'M' cells. Glands are few penetrating deeply into lymphoid tissue. Lymphoid tissue in the lamina propria contains many plasma cells with lymphocytes, eosinophils and leucocytes, mast cells, macrophages are embedded in fibrocellular reticulum.

In many mammals, particularly herbivores the caecum and appendix are large and constitute a highly important site of digestion of cellulose by symbiotic bacteria.

ETIOPATHOGENESIS [19-25]

Etiological factors are predisposing and exciting factors.

1. PREDISPOSING FACTORS :

- **Age:-** Commonest in the 20 t 30 years of age . Rare in infants and old aged . In infants the lumen of the appendix is relatively large. In older age group appendix undergoes involution commonly.

- **Sex:** Males preponderance common. Before puberty ratio is **1: 1 ,** post pubertal **2:1** till 25 years.

- **Race and diet :** Appendicitis being common in high socio-economic status and certain communities, is rarely seen in low socio-economic groups also among primitive people. Natives

who live on a diet abundant in cellulose are immune to the disease, but when they adopt the diet of other civilizations they lose that immunity. The severe gangrenous type of appendicitis is confined to people having meat in their diet. Acute appendicitis occurs in life long vegetarians and even in babies at the breast. Denis P Burkitt after extensive research concluded that undue refining of dietary carbohydrates is the most important causative factor.

- **Social Status:** more common among the upper and middle class than in those belonging to the so called working class.

- **Familial susceptibility:** This unusual but generally accepted fact can be accounted for by a hereditary abnormality in position of organ, which predisposes to infection . Thus the whole family may have a long retrocaecal appendix with comparatively poor blood supply.

2. EXCITING FACTORS:

- **Obstruction :** Wangenstein and Bowers discovered obstruction in 72% of cases with acute suppurative appendicitis and in cases with gangrenous appendicitis it was 100%. When obstruction sets in, the lumen becomes distended, and the intraluminal pressure is rapidly increased and the venous return is interfered, leading to the rupture of the vessels, haemorrhage occurs when the wall is hypoxic and when there is bacterial invasion, there is increase in the swelling and as a

result it ends up in perforation. In an experimental study in dogs Wangenstein and Bowers found that obstruction without infection or infection without obstruction did not cause inflammation. In man it appears that pressure distension is the exciting factor, bacterial invasion of the injured wall being secondary. According to this view acute appendicitis is a form of closed intestinal obstruction.

- **Infection:** It occurs as a secondary mechanism to mucosal destruction. Cultures usually show a wide range of pyogenic organisms. Commonly seen organisms are mixture of Esch.coli (85%), Enterococcus (30%). Non-anaerobic bacteroids and Esch.coli are the more frequent. Organisms that commonly infect are the normal inhabitants of the appendiceal lumen. Blood spread from thoracic infection, tonsils and other regions is quiet possibile, in some circumstances there is history of preceding sore throat before the onset of an acute attack.

PATHOLOGY [22,25]

Acute appendicitis can present in various distinct forms. An histologic criteria for diagnosis of appendiceal inflammation is polymorphous leucocytic infiltration of muscularis mucosa.

CATARRHAL APPENDICITIS:

There is usually mild Inflammation and symptoms.

- **Gross:** The serosa appears infected, with appearance of dull

granular red membrane. There is congestion of subserosal vessels.

Mucosa and submucosa are inflamed. Mucosal ulcers will be seen usually. There is no obstruction of the lumen.

- **Micro:** Scanty neutrophilic exudates seen all over the mucosa, submucosa and muscularis.Scanty perivascular neutrophilic migration.

ACUTE SUPPURATIVE APPENDICITIS:

Inflamation is severer and purulent. Usually bottom of the crypts gets infected first. From there, it spreads in to the loose submucosa then muscularis,then to the vessels penetrating into the serosal layer.

- **Gross:** Lengthened and oedematous and erythematous appendix, with dilated sub peritoneal vessels and fibrous or purulent exudates on the surface. Yellowish spots are seen on the surface pointing the formation of an abscess. Tip is usually edematous and the entire pathology is less marked in the proximal and highly marked in the distal part. A cause of obstruction is almost present and is usually a lethal variant.

- **Micro:** There is congestion on all coats of the appendix with oedema and infiltration of polymorphonuclear leucocytes, and the mucosal membrane can exhibit little or nil infiltration. Ulcer formation is usually seen as a result of mucosal necrosis and dead membrane masses which are cast off , usually at the points where the

lymphoid follicles approach the surface. Haemorrhage are seen scattered in the core coat - acute haemorrhagic appendicitis.

At any stage of the inflammation perforation is prone, but is ucommonly associated with gangrene. Mucosal ulcers may penetrate the mucosal and serosa layers leading to perforation. A faeco-lith is commonly present at the site of the perforation and plays a pivotal part in its production. It can slip into the cavity of abdomen occasionally . A full blown peritonitis is seen as a result of perforation in to the peritoneal cavity.

GANGRENOUS APPENDICITIS.

It is an advanced stage of acute appendicitis. There is death and putrefaction of tissues of the appendix either local or general, due to interference with blood supply due to kinking or stricture of the appendix or thrombosis of the vessel that is traversing in the lumen of the appendix.

RECURRENT APPENDICITIS

Chronic inflammation of the appendix is usually a task for the pathologist to diagnose. Chronic appendicitis per se does not exist. Patients present when there is recurrence of the disease .

- **Gross:** oedema and fibrosis of the appendix lumen is seen and may be narrowed or obliterated completely.

- **Micro:** Infiltration of mononuclear cells in to the wall, especially in the submucosal layer and is often seen in association with huge lymphoid follicles. Mucosa and submucosa are infiltrated by large number of lymphocytes. Majority of the appendix labelled as chronic appendicitis are almost usually examples of healing after an acute attack.

APPENDICITIS OBLITERANS:

Atrophied and degenerated appendix with no possible relation for inflammation of appendix.

EFFECT OF APPENDICITIS ON ILEOCAECAL REGION:

Inflammatory reaction in the ileocaecal region may lead to oedema, acute adhesions and angulation of the ileum leading to obstruction of the bowel, organic obstruction merging with paralytic ileus.

CLINICAL FEATURES [22-27]

The physical signs of acute appendicitis are not specific but merely those produced by local peritoneal irritation in the right iliac fossa.

SYMPTOMS:

Patient presenting with acute inflammation of appendix can exhibit the triad of pain,vomiting and fever (Murphy's syndrome),

but it is not always so. Atypical presentations are not uncommon.

- **Pain:** In acute appendicitis, when there is inflammation of the appendix and increase in the intraluminal pressure, the sympathetic nerves are stimulated.

The "visceral" pain which is initially felt around the umbilicus and lower epigastric regions, is a moderate to severe, diffuse pain. Intermittent cramps can be felt occasionally. Because of the embryonal origin of appendix, pain is usually confined to the midline. This pain usually last for around 1 to 12 hours, and when the inflammation extends and involves the serosal layer, the somatic nerves of the peritoneum are stimulated and then a constant and continuous pain is felt in the right iliac fossa- "Somatic Pain" In case of obstruction, experience of colicky pain is common. In gangrenous appendicitis pain is experienced in initial stages, and there is destruction of nerve endings at a latestage. Once perforation occurs, and infection is not controlled by local or general factors, constant severe and generalized abdominal pain of diffuse peritonitis occurs.

- **Atypical pain :** appendix in malrotated gut, produces somatic pain in left lower abdomen. A long appendix may also produce it with its tip on the left part of the abdomen.

- **Vomiting, nausea, and anoreia :** Vomiting is usually seen in the early stages of acute appendicitis ,but usually few hours after to

initial pain due to protective pylorospasm. Nausea is usually the major complaint than vomiting as many patients do not experience . In most of the cases dyspepsia is a common feature.Loss of appetite or repulsion for food may be regarded as a lesser degree of the same sensation and often of equal value in diagnosis. An individual with previously good health when suddenly loses appetite and complaints of pain abdomen needs to be carefully monitored.

The degree of nausea and the frequency of vomiting in the early stage appear tobe depend on two factors - one the amount of distension of the inflamed appendix, and two the reflux nervous susceptibility for the patients. Vomiting is more prone to occur in kids, or in patients in whom the alimentary tract is easily deranged.

It may be taken as an important general rule that the frequency and severity of the vomiting at the onset of an attack of appendicitis indicate the degree of distension of the appendix and consequently the immediate risk to the patient that perforation may occur. Persistent regurgitant vomiting occurs with diffuse peritonitis.

•**Bowel disturbance:** Constipation is common. Diarrhoea can occur in pre or post ileal positions of the appendix because of the irritation of the distal ileum. Pelvic abscess can irritate the distal gut leading to frequent bowel evacuation or tenesmus.

•**Urinary disturbance:**Irritation of the ureters by the retrocaecal appendix may give rise to pain mimicking right ureteric colic. Increased frequency of micturition, hematuria or dysuria can occur due to the irritation by the inflamed pelvic appendix.

SYSTEMIC MANIFESTATIONS:

- **Fever:** fever i.e is of low grade is not uncommon. When fever sets in before the abdominal pain or is of high degree, the diagnosis is questioned.Tongue is coated. Tachycardia and mild dehydration are seen. In perforated appendix, full blown peritonitis results.

- **Local signs:** If the appendix is anteriorly placed, physical signs are elicitable over the anterior abdominal wall. There may be mild restriction of movement of the right lower abdomen with respiration.

- **Tenderness:** is usually elicitable over the Mc Burney's point

- **Guarding and rigidity:** Guarding is an protective involuntary mechanism. True and false guarding must be sort out. Guarding is commonly present in the right iliac fossa and lower abdomen. Rigidity is seen when there is peritonitis.

- Muscular rigidity is seen when appendix comes in contact with the muscle .

CLINICAL TEST DESCRIBED WITH REFERENCE TO APPENDICITIS.

- **Mc Burney's sign:** Tenderness during palpation over Mc burney's point, where the appendiceal base is said to be situated.

- **Rovsing's sign:** Pressure on the Lif produces pain over right lower quadrant of abdomen. It was primarily thought to be due to shift of gas in the colon into the caecum, distending it, and the inflammatory phlegmon around. But Williams proved that this sign is positive in inflamed lesions of any organ in right lower abdomen. This sign is probably due to the shift of the coils of ileum from the left iliac fossa to right iliac fossa, where there is local peritonitis .

- **Blumberg's sign:** Eliciting rebound tenderness over Rif , after deep palpation.

- **Psoas test :** It is because of irritation of the psoas muscle seen in a inflammed retrocaecal appendix, patient lying on his left side when extends his right thigh, exhibits pain.

- **Cope's obturator test:** When the right thigh is flexed and internally rotated, if the appendiceal inflammation is in contact with obturator muscle, pain is felt over hypogastric region.

- **Hyperasthesia in Sherren's triangle :** line adjoining the umbilicus, RT ASIS and pubic symphysis form Sherren's triangle. Pinching a fold of skin and subcutaneous fat and pulling it away from the

abdominal wall or by stroking with a sharp object elicit this. Some clinicians regard presence of hyperesthesia in Sherrens triangle as a good guide in the diagnosis of acute appendicitis before perforation. If, in such a case hyperesthesia disappears later on, it indicated the bursting of the gangrenous appendix.

- **Baldwin's test:** Finger locates the tenderest spot over flank, compressing it slightly just enough to cause little pain. Patient is adviced to lift his right leg few inches off the bed, holding the knee stiff. When patient promptly complaints pain or drops the leg with pain, test is considered positive. It indicated retrocaecal appendicitis.

- **Pointing test:** In acute appendicitis patient points to right lower abdomen pain on coughing, pointing to the site of inflammation. Its due to the irritation of parietal peritoneum by the inflamed organ.

- **Auscultation:** Bowel sounds are usually normal. Hyper peristaltic sounds are heard when there is an element of intestinal obstruction.

Tinkling sounds are heard once paralytic ileus occurs secondary to generalized peritonitis.

- **Pelvic examination**: Differential tenderness on the right side, is significant in the cases of pelvic position of the inflamed organ. In case of pelvic abscess, a tender boggy feel pointing into the rectum is felt.

VARIATIONS IN CLINICAL PRESENTATIONS ACCORDING TO THE VARIOUS POSITIONS OF THE APPENDIX.

- **Retrocaecal appendix:** In this position, because of the intervening caecum between the inflamed appendix and the anterior abdominal wall, rigidity is not marked. Tenderness may be elicited over the right flank, as also is the rigidity (Baldwin's test). Psoas test may be positive.

- **Subcaecal appendix :** Appendix is curled up below the caecum and is in contact with the iliacus muscle and so, the extension of the hip becomes painful due to spasm of the muscle, and pain is felt in the hypogastrium.

- **Pelvic appendix:** When the appendix is almost entirely in the pelvis, the clinical signs may be absent over the anterior abdominal wall. Often, even the Mc Burney's sign may be negative. Pelvic examination detects tenderness on the right side. Obturator spasm may be present rarely. Patient may have symptoms of strangury or dysuria or tenesmus, due to irritation of the urinary bladder or rectum.

- **Sub hepatic appendix** : Due to its undescended position, the clinical signs are referable to the right upper abdomen. A mild

degree of jaundice and very rarely hematemesis may occur due to its contact with pylorus.

- **Retroperitoneal appendix:** A retrocaecal appendix is totally retroperitoneal organ. In these cases, tenderness over the abdomen may be absent. Tenderness over the loin may be present. Hematuria is known to occur in nearly 50% of these cases. Several complications like retroperitoneal or sub diaphragmatic abscess, empyema, bronchial fistula, psoas abscess, etc., are known to occur.

- **Post ileal or retro mesenteric appendix:** Because of its position, inflammation of appendix in these cases is dangerous. Acute inflammation does not give rise to the clinical symptoms or signs. Irritation of the ileum leads to frequent bowel evacuations initially. This is followed by paralytic ileus and distended coils may mask the underlying appendicular mass or abscess. Tenderness on the right iliac fossa is elicitable only on deep palpation. When the distended coils sink down to the pelvis, they may irritate the large bowel and may again produce diarrhoea.

INVESTIGATIONS.[22-24,26,28]

TOTAL WHITE CELL COUNT:

A noticeable overlap is present between total leucocyte count and neutrophil counts of healthy individuals and those with acute appendicitis. Interpretation of neutrophil and leucocyte counts together is important and significant than interpreting a single count.

It is clear that 80 to 85% of patients with appendiceal inflammation will have a total WBC count of > 10,000/mm^3. When the WBC counts and neutrophilic counts are taken together, < 4% of patients with inflamed appendix will have normal levels. Having said,the WBC count is increased in 25 to 70% patients with other cause of right iliac fossa pain. Leucocytes is increased with the duration of the disease process, even a appendiceal perforation may present with a normal wbc count. Others suggested that the wbc count and neutrophilic count is very sensitive in children (Doraiswamy.N.V.1979).

In elderly patients with appendiceal inflammation the WBC count has been markedly reported as being, either reliable (Berry.J : Malt. 1984. Smithy 1984: Owens 1978: Burns 1985; Pelto Kallio. 1970) or Unreliable (Law.WY. !985; Hubbell. 1961).

In addition an increase in the percentage of neutrophils THE LEFT SHIFT with normal total wbc count supports the clinical diagnosis of appendicitis.

A raised WBC count has a high sensitivity for appendiceal inflammation, it has low specificity and its value seem to be prompt in a patient who has equivocal features of appendicitis.

URINE ANALYSIS[29]

Minimum albuminuria and few white blood cells in the urine are seen in 20% of male patients with appendiceal inflammation. Lacy, McDonald (1964) reviewed the records of 128 patients, who underwent appendectomy for acute appendicitis and found microscopic pyuria in 19% (15-20 cells/HPF) and hematuria 5% (30 - 50 cells/HPF). The incidence of urinary findings was more in patients over 40years of age.

CHEST X RAYS:

Helps to rule out lung infections and overall assessment for surgical fitness of the patient.

PLAIN X RAY ABDOMEN:

Good numbers of radiological signs are described. Brooks and keller(1965) listed them as follows.

•Fluid level localised to the caecum and to the terminal ileum, indicating local inflammation in right lower quadrant .

- Increased soft tissue density over right lower part of abdomen.
- Faecolith in the RIF (which can be mistaken for ureteric stone,

gall stones, or a calcified mesenteric nodes).

- Blurring of psoas shadow on the right quadrant of abdomen
- Pneumo appendix.
- Free intraperitoneal gas with perforated appendix.
- Deformed caecal gas shadow due to inflamed adjacent mass.

However there are no radiological signs that is pathognomonic, there are certain signs, which may point towards diagnosis of acute appendicitis. (Brooks D.W.1965. Soteropoulos C. 1958; Casper R.B. 1970). None of the above signs are specific to appendiceal inflammation, they can be found in patients with other causes of right iliac fossa pain and in many normal subjects.

Further more irradiation hazards, especially women of reproductive age-group and childrens as well as the cost and over loading of radiology departments make this investigation a tool with low diagnostic score.

BARIUM ENEMA STUDY [30-32]

Radiologic signs of acute appendicitis after barium enema.

- Persistently no visualization of the appendix (5 - 10% normal appendix cannot be visualized)
- Partial visualization

- Pressure effects on the caecum
- Irritability of the caecum or ileum as demonstrated by fluoroscopy.

Barium enema is accurate in diagnosing acute inflammation but may be technically unsatisfactory or nondiagnostic in some cases. Other advantages are that barium enema also diagnoses other disease, that can be confused with appendicitis when acute. Its disadvantage lies in its relatively higher rates of faulty techniques and its hazardous radiations. It can also lead to perforation.

ULTRASONOGRAPHY[33,34]

Newer studies with high resolution real time ultrasonography have shown that visualization of a non-compressible appendix appears to be a sensitive method of investigation. A normal appendix is usually not visualized, or if visualized, it is compressible. The varying echo-density of the lumen, with thickening of the inflamed appendiceal wall gives a characteristic sonographic picture, which is termed as “bulls eye” or “target”

Pearson (1988) described the ultrasonic appearance of acute appendicitis as a non-compressible, peristaltic tubular structure with a central dilated lumen surrounded by a inner echogenic mucosal layer and an outer oedematous wall that shows few echoes. Ultrasonography is highly attractive. The sensitivity ranges from75 to 89% and specificity from 86 to 100%. Less accurate results are reported for

retrocaecal appendices, early appendices, and perforated appendices.

Besides being highly specific in the hands of the expert ultrasound has further advantage in excluding other diseases. Its main disadvantage lies in the fact that it requires special equipment and special expertise and it is difficult to use in the obese and fatty.

CT SCAN [35-37]

Computed tomography can diagnose acute appendiceal inflammation. It has been accurate for advanced cases and not very accurate in early appendiceal inflammation. Such a highly sophisticated and expensive apparatus can hardly be expected to be used in day to day diagnosis of acute appendicitis.

LAPAROSCOPY [38,39]

Laparoscopy with the attraction of being the only investigation that can view the appendix directly. Negative laparotomy can be obtained in as many as one quarter to one half of the patients by using laparoscopy. The main drawback of laparoscope is that it is invasive. It requires general anaesthesia. An other disadvantage being it warrants special equipment and expertise.

DIAGNOSTIC PERITONEAL ASPIRATION OR LAVAGE:

The presence of pus or a leucocyte rich fluid in an elderly Patient with right iliac fossa signs would suggest appendicitis as both gynaecological infection and mesenteric adenitis are unlikely

which may confuse with acute appendicitis[46].

C-REACTIVE PROTEIN

Measurement of CRP can increase the accuracy in diagnosing acute appendicitis[50].

DIFFERENTIAL DIAGNOSIS OF ACUTE APPENDICITIS

Diagnosis of appendicitis can be extremely difficult. It is wise to consider carefully possible disease of the chest, the abdomen, the pelvis, the genitourinary system, the central nervous system and the spine[16].

- **Tonsillitis :** In children abdominal colic may arise from swallowed exudates (tonsil tummy)

- **Pneumonia and Pleurisy:** especially right basal gives rise to right sided abdominal pain, but they are associated with increased respiratory rate and the pain prevents deep inspiration. Pleural friction or altered breath sounds on auscultation and a chest x-ray may be helpful. The gall bladder, the duodenum, and the right kidney are the viscera in anatomical proximity to the appendix and

inflammation of them or their surroundings may cause difficulty in diagnosis.

• **Cholecystitis :** The pain in cholecystitis is usually higher than that of appendicitis, and there may be pain of a segmental nature referred to right sub scapular region. There may be resonance of the ascending colon over an inflamed, retrocaecal appendix. There is never resonance in front of an inflamed gall-bladder, which is usually on a plane anterior to the caecum, colon and appendix. In very stout subjects and in patients with very rigid abdominal muscles it may on occasion be almost impossible to diagnose whether the appendix or gall-bladder is involved, unless the previous history be clearly indicative of one or other condition .

• **Perforated peptic ulcer:** History of dyspepsia and very acute onset of pain, starting in the epigastrium. The escaping contents travel down the right Para-colic gutter and give rise to all the signs of inflammation of the appendix. It may be possible to obtain a typical duodenal or appendicular history. The initial shock at onset is greater in the duodenal condition, and there will also be definite right hypochondriac tenderness. Pain felt on top of the right shoulder would be more in favour of a perforated duodenal ulcer. If there is obliteration of liver dullness, in the absence of general abdominal distension, a peptic perforation is certain.

- **Torsion of omentum:** Torsion and strangulation of the whole or of a portion of the omentum may simulate appendicitis. The part affected is usually to the right of the midline and pain and tenderness will be noted to the right of the umbilicus. If the affected fat becomes adherent to the abdominal wall there may be superficial hyperesthesia. Pain due to torsion of omentum is relieved when the patient lies down.

- **Cyclical vomiting :** The patient is an infant or young child and there is similar history of previous attacks. Rigidity is absent and acetone is found in the urine, but acetonuria may accompany starvation.

- **Enterocolitis:** History of epidemic diarrhoea and vomiting, intestinal colic, but no localized tenderness. Post ileal appendicitis may completely mimic this condition.

- **Non-specific mesenteric lymphadenitis:** The patient is usually a child, is absolutely free of pain between the attacks, it lasts for a few minutes. Shifting tenderness when the child turns on to the opposite side, is present, is a convincing evidence.

- **Tuberculous ileocaecal glands:** Tuberculous ileocaecal glands are easily mistaken for an inflamed appendix. They occur chiefly in children, and cause slight tenderness, and may be a lump, in the right iliac fossa. If the glands are fleshy and tend to undergo caseation they may cause inflammation of the contiguous mesentery and

peritoneum, and the local signs will be increased by the presence of greater local tenderness and possibly muscular rigidity.

Nausea, or vomiting may occur, but epigastric pain is not so likely to be in evidence, and the typical symptom sequence will not be obtained.

- Tuberculous mesenteric glands may be accompanied by an irregular fever. Plain x-ray of the abdomen may reveal calcification in the glands.

- **Intestinal obstruction: Small bowel:** Obstruction of the ileum, accompanied by tenderness in the hypogastrium is frequently due to adhesions caused by previous attacks of appendicitis. The adhesions usually bind the end of the ileum down to the lateral walls of pelvis or to bottom of pelvic pouch of peritoneum. The previous history of appendicitis may be misleading.

Distinction is to be made by noting that in obstruction there is greater acuteness of pain, which is of spasmodic nature and by observing the frequency and character of vomit, which in obstruction gradually becomes yellowish and finally feculent, a change that never happens in appendicitis until extensive peritonitis has developed. In intestinal obstruction the pain is seldom localized to the right iliac fossa as in appendicitis but after distension has supervened diagnosis is made much more difficult. In small bowel

obstruction the temperature is usually subnormal at onset, and does not at any period become febrile as is usual in appendicitis. Frequency of micturition or pain during the act may occur in appendicitis, owing to irritation of the bladder.

Large Bowel: Obstruction of the large bowel causing hypogastric symptoms is commonly due to carcinoma of the sigmoid or rectum, or due to volvulus. In pelvic appendicitis the symptom sequence is fairly constant and distention is not an early symptom. In both cases rectal examination will reveal pelvic tenderness. In obstruction there may be greater ballooning of the upper part of the rectum, whilst in appendicitis there is often a tender lump on to the right side of pelvis, the thigh rotation test may be positive. Fever is usually absent in obstruction, and present in appendicitis.

- **Regional ileitis:** In its acute form is difficult to distinguish from acute appendiceal inflammation unless a doughy mass of inflamed ileum is felt. A history of diarrhoea suggests regional ileitis than appendicitis.

- **Carcinoma of the caecum**: When obstructed may very well mimic appendicitis in patients in the carcinoma age group.

- **Meckel's diverticulum:** The symptoms of Meckel's diverticulitis without perforation are that of acute appendicitis and the diagnosis is impossible before operation

• **Salpingitis:** History of vaginal discharge, menstrual irregularities and dysmenorrhoea or burning pain during micturition. The onset of symptoms usually follows a menstrual period and the pain starts low down and remains there. On rectal or vaginal examination the enlarged tender fallopian tubes may be palpated.

• **Ectopic gestation :** In Right sided unruptured tubal pregnancy, the signs are similar to acute appendicitis, except that the pain starting on the right side remains there. Pain is intolerable and continues unchanged till surgery, History of a amenorrhoea is present. The cervix is soft and severe pain is felt cervix is moved on examination. In tubal abortion, signs of intraperitoneal bleed dominates. After sometime patient may complain of referred pain in the shoulder when foot end is elevated for half an hour.

• **Ruptured ovarian follicle:** Occurs on fourteenth to sixteenth day between a period, especially in early womanhood. The signs are similar to those of early tubal abortion, but the history of a missed period and soft cervix is absent. There is often history of such attacks and the condition does not progress.

• **Twisted right ovarian cyst:** Pain is severe, often referred to the loin and is made worse, when the patient rolls over. The pulse rate rises while the temperature remains normal. Pelvic examination under anaesthesia might help to come to a diagnosis.

- **Diverticulum of the caecum:** Is Rare. When inflamed is indistinguishable from acute appendicitis.

- **Right ureteric colic:** Pain commences in the loin and passes to the groin. Urinary symptoms will be present.

- Tenderness in the right iliac fossa will be present, if colic is due to stone. Pointing test is negative. Plain x-ray, urine microscopy, ultrasound of the abdomen and IVP will help diagnosis.

- **Right sided acute pyelonephritis:** Usually associated and preceded with increased frequency to micturate. The leading features are fever, rigors, pyuria and tenderness confined to the loin.

- **Herpes :** Preherpetic pain in ninth, tenth and eleventh dorsal nerves is localized similar to acute appendicitis. There is no shift and is associated with hyperesthesia markedly. No small bowel symptoms.

- **Tabetic crisis:** Abdomen pain which is severe and vomiting usher in the crisis. Other features of tabes confirm the diagnosis.

- **Spinal conditions:** Occasionally associated with acute abdomen pain which is acute especially in children and the old age. These include Pott's disease, secondary carcinomatous deposits, senile osteoporosis and myelomatosis.Pain is essentially due to compression of the nerve roots and may be precipitated by movements. There

is rigidity of the lumbar spine and small bowel manifestations are not present. Spinal x-ray will often be a guide.

OTHER CONDITIONS TO BE REMEMBERED:

- **The abdominal crisis of porphyria:** Characterised by violent intestinal colic with constipation and passing of orange coloured urine. Plain x-ray of the abdomen often displays short segments of intestinal spasm with related gaseous distensions of the small and large bowel.

- **Diabetic abdomen:** Severe abdominal pain and vomiting, which occasionally precedes coma. The urine should be tested in every abdominal emergency.

COMPLICATIONS OF ACUTE APPENDICITIS [22,40]

LOCALISED PERITONITIS:

If the infection has spread to the entire thickness of the appendiceal wall, there is local inflammation of peritoneum leading on to local peritonitis. Until the infection gets to cease/control locally, no further spread occurs, otherswise full blown peritonitis results.

DIFFUSE PERITONITIS:

Peritoneal cavity in toto may get inflamed by one of the following ways:

- Inflamed appendix acutely perforates or ruptures before the localising factors can localise the infectious spread.
- Patients with very poor general conditions ,or in immunocompromised patients.
- If organisms exhibit increased virulence the infection will spread to the general peritoneal cavity.

APPENDICULAR MASS

A walled off appendiceal inflammation will result in the formation of an appendicular mass. These patients usually have an history of 4 to 5 days. Clinical features are usually surging temperature with tachycardia.

There is a tender mass in the right iliac fossa that can often also be palpated on rectal examination. Mass is fixed usually to the posterior wall of the abdomen.

PATHOGENESIS:- Gradual process of inflammation in appendix, provokes a fibrinoplastic reaction in the area surrounding it, localises infection, before perforation has time to occur. This occurs when the resistance of the patient is good and or the

virulence of the organism is low. A inflammatory mass forms comprising the appendix, surrounded by layers of omentum and neighbouring loops of intestines, together with the sero-fibrinous exudates. Some part of the mass is attached to the parietal peritoneum. This mass usually undergoes spontaneous resolution under favourable conditions. In about two days pus accumulates in the center of the mass and the fibrins organize around to form an appendicular abscess.

APPENDICULAR ABSCESS:-

Failure of the appendicular mass to resolve leads to the formation of abscess.

CLINICAL FEATURES:- signs of increasing toxicity appear. The mass and also the area of tenderness enlarge. Fluctuation is elicitable from the tender bulge. Patient may have tenesmus or strangury or dysuria if pelvic in position.

If the abscess appears on the right flank, signs appear mimicking a classical perinephric abscess. The preileal abscess irritates ileum leading to diarrhoea. Abscess spreads open into the general peritoneal cavity causing diffuse peritonitis.

ILEAL OBSTRUCTION:

Paralytic ileus is common during the stage of inflammation. Occasionally adhesion around the distal ileum leads organic obstruction.

MESENTERIC VEIN THROMBOSIS:

Appendicular vein thrombosis may progress and involve the mesenteric vein. This might result in haemorrhagic infarction and gangrene of the distal ileum, warranting resection.

PYELOPHLEBITIS AND LIVER ABSCESS:

Infection of the appendix can spread retrograde to the liver, due to portal pyemia. This complication can occur during an acute appendicitis or even after 6 weeks after the attack.

EXTERNAL OR INTERNAL FISTULA:

Rupture of an appendicular abscess through the skin, forms an external fistula and discharges feces.

Perforation of appendix into a viscous, depending on the viscous, it can form appendico-vesical fistula, appendico-ileal fistula, appendico-jejunal fistula, appendico-sigmoid fistula, appendico-cutaneous.

Symptoms in these cases are due to the discharge of contents from the appendix into the viscous as well as, may be due to the herniation of bowel below the fistulous tract and obstruction of the same.

ACUTE APPENDICITIS IN SOME SPECIAL SITUATIONS

ACUTE APPENDICITS IN PREGNANCY:

Appendicitis is a very common emergency surgically warranting surgery during pregnancy. Diagnosis is often difficult. Clinical findings may be masked or altered by the displacement of the appendix to cephalic position as pregnancy progresses. Delay in treatment may result in death of the foetus or mother or both.

- **Incidence:** 0.40 per thousand pregnancy.

- **Age and Parity :** Common in 20-25 years age groups, but the age range extends from 14 to 34 years. More commonly witnessed in women having multiple pregnancies.

- **Duration of Pregnancy:** Commonly in the second trimester and less common in the third trimester.

- **Clinical features:** Eighty percent have symptoms of < 24 hours. Duration of symptoms range from 6 hrs to 6 days. Anorexia is present in almost all the patients. Common complaints being vomiting and nausea. Dysuria infrequent. Pain and tenderness in the right lower quadrant of the abdomen was observed more commonly in the first six months of pregnancy. Diffuse abdominal pain and tenderness were seen during third trimester. Classical signs and symptoms of appendicitis may be present with additional symptoms, often, the first

is uterine contractions. Abdominal pain and tenderness is situated more laterally and higher as pregnancy advances.

Rebound tenderness and muscle guarding are found less frequently, but valuable finding in the diagnosis of acute appendicitis.

- **Laparoscopy :** Most of the time diagnostic, greatly improves management of the patient and often makes laparotomy unwarranted.

- **Tocolytic agents :** Prevents uterine contractions. Prophylactic tocolytics have been used with good effect.

- **Antibiotics :** Is usually reserved for patients with clinical evidence of gangrenous or perforated appendix and is of no advantage in non-perforated appendix.

- **Operation :** Under general anaesthesia.

- **Incision :** According to the gestational age type and location of the incision varies. A muscle splitting incision centered over the point of maximum tenderness provides excellent exposure, and tilting the patient 90 degree towards left side can be of aid. Simultaneously caesarean section can be done.

- **Maternal and foetal mortality :** Maternal mortality has declined and is now 0.01% given by Babanknia et al, 1977. Foetal loss has also decreased. Mortality rate is 35%. Delay to intervene surgically is a reason of maternal mortality and of foetal loss.

• Baer et al in 1932 demonstrated the variations in the position of the appendix caused by the enlarged uterus. Fifth month, at the iliac crest level and rises above this level during the last trimester.

ACUTE APPENDICITIS IN CHILDREN

Diarrhoea is more common than constipation in children. The appendix being in contact with rectum, a rectal examination is important. Frequency of micturition could be because of inflamed appendix in contact with bladder. A child sometimes postpones micturition as this causes pain. Abdomen is distended, respiratory movement decreased. Palpation is facilitated by distracting the attention of the child or by sedation if needed. A plain X ray of the abdomen may show a calcified appendicolith. Appendectomy should be performed whenever this radiologic finding is present.

The disease is more rapidly progressive than adults. Gangrene and rupture occur earlier in the course. The incidence of perforation varies from 30 - 50%. The walling off process is less efficient because of small and incomplete development of greater omentum.

Management is prompt appendectomy for simple appendicitis. For Perforated appendicitis a standard horizontal muscle splitting incision is used. In most, the perforated appendix may be removed safely. In other the appendiceal abscess is drained with Penrose drain and a interval appendectomy performed 4-8 weeks later.

APPENDICITIS IN THE ELDERLY:

The classic symptoms of acute appendicitis are seldom seen in the elderly patient. Lous et al and Hubbeelk et al have noted the variation in the clinical presentation, the increased incidence of appendicial rupture and the increase in both number and severity of complications including death in the elderly. The incidence was 1% in patients above 60 years in the series published by Fitz in 1884. One in 5 had no temperature elevation. One in ten did not have leucocytosis. Diagnostic accuracy is about 70% (J.S. William, 1965).

The mortality rate is high (14%) and is related to three factors: delay in treatment, progressive uncontrolled infection and high incidence of associated diseases. The complication rate was as high as 45%.

ATYPICAL PRESENTATIONS IN ACUTE APPENDICITIS:

- Acute appendicitis with diarrhoea: Diarrhoea is significant sign in case of pelvic appendicitis, denoting irritation of the rectum with infected peritoneal exudates.

- Acute appendicitis with hyperpyrexia :Some fulminating cases of acute appendicitis the disease maybe ushered with very high temp

- Acute appendicitis without rigidity of the abdominal muscles:

a)When the patient is examined early during the course of the disease,

when the appendix lies deeply on the pelvis.

b)When the appendix is situated behind the caecum and the colon and retroperitoneal.

c)When the inflammatory process is halted or is subdued for a time by antibiotics.

d) Acute Appendicitis with hematuria.

APPENDICITIS WITH HIRSCHSPRUNG'S DISEASE:

In 1967, Martin described association between neonatal perforation of appendix and Hirschprung's disease and quoted 3 such cases.

In new born babies, the common cause of the large bowel obstruction is, Hirschprung's disease, imperforate anus, meconium plug, etc. This leads on to over distension of the caecum and appendix. The appendix or caecum may perforate. The treatment comprises of rectifying the primary underlying disease, along with appendectomy.

ACTINOMYCOSIS ASSOCIATED WITH APPENDICITIS:

Actinomyces is an anaerobic micro-organism. The organism may be present in the lumen of the appendix. After appendectomy it may gain a foothold in the devitalized appendicular stump and may lead on to an external fistula. The external fistula discharges sulphur granules. The disease should be suspected if an external non-healing fistula, discharging sulphur granules occurs after appendectomy. Patient may need a prolonged course of medical

treatment with penicillin for 3 weeks and constant follow up for a few months.

ACUTE APPENDICITIS AND CROHN'S DISEASE:

The appendix may be inflamed in Crohn's disease or it may be found to be normal in the course of an emergency operation in Crohn's disease patient. There is unanimous agreement that appendectomy is indicated when the appendix is inflamed, in the general population as well as in Crohn's disease patient.

The recommendation not to perform an appendectomy whenever the appendix looks normal and the caecum is inflamed is well established.

CHRONIC SCHISTOSOMAL APPENDICITS:

Diagnosis of schistosomal infection of the appendix could be a incidental finding in the endemic area. But, however, it is known to cause recurrent or chronic appendicitis and the possibility must be thought of in those areas.

Bowerman estimated in West Africa about 20% of cases of chronic appendiceal inflammation were due to schistomiasis.

APPENDICITIS DUE TO PARASITIC INFESTATIONS :

Parasites infesting the guts may enter the appendix and may occasionally cause luminal obstruction or local inflammatory reaction.

Enterobius vemicularis is stated to be the commonest infesting organism.

Stephenson, 1961, in a survey of 4000 consecutive appendices found infestation of enterobius vermicularis in 2% of all appendices and 12% of those were associated with acute inflammation.

Nelson states that worms get attached to the mucosa, without causing appreciable damage, but they may cause haemorrhage from the mucosal wall, or provide opening for the invasion of the bacteria resulting in sub mucosal abscess.

APPENDICITIS WITH TUMORS OF THE APPENDIX :

(a) Carcinoid (c) Adenocarcinoma

(b) Mucinous cyst adenoma (d) Sarcomas

- **Carcinoid tumour :** Most common and constitutes 90% of all primary tumours of appendix. The tumour occurs usually in the tip than the base and obstruction of the lumen by the tumour is rare. The tumour may be found incidentally in the appendectomy specimen.

- **Mucinous cyst adenocarcinoma :** They present as a malignant mucocele of the appendix unless the mucocele has ruptured. Appendectomy will suffice.

- **Sarcomas:** Rare and very little is known about the sarcomas of the appendix. Majority of the cases are lymphosarcomas. Radical

surgery is needed according to the case, with or without radiotherapy.

- **Adenocarcinoma:** Collin found adenocarcinoma in 41 of 50,000 appendices examined histopathologically. It rarely leads to appendicitis. Right hemi colectomy is the treatment of choice.

TUBERCULOSIS OF THE APPENDIX:

This presentation is seen as acute appendicitis or recurrent appendicitis. It is always seen in conjunction with ileocaecal tuberculosis. Diagnosis is only on histopathology.

TREATMENT [22-24,26]

"The earlier the operation, the lower the mortality" J.B.Murphy. Prompt diagnosis and early surgical modality is still the most vital principle in dealing with acute appendiceal inflammation and this holds good for patients in all age groups.

PRE-OPERATIVE

A few hours and not more than 6 hours is set aside for pre-operative preparation.

Clinical examination : Laboratory investigations and radiological examinations, followed by

- Patient kept nil orally
- Nasogastric tube should be passed to aspirate all gastric contents.
- Parenteral fluid therapy to correct fluid , electrolyte balance.

- Analgesics are given for pain anxiety.
- Antibiotics given parenterally for control of infection.
- Enemas are contraindicated
- Maintaining input and output chart
- Preparing the abdomen for laparotomy.

OPERATIVE PROCEDURE:

Anaesthesia General or spinal anaesthesia

- **Choice of incision**[22,40] With the experience of the surgeon he should determine with a fair degree of accuracy before surgery the position and changes in the appendix and the choice of incision.
- **Grid-Iron incision:** This was first described by McArthur in 1894, today it is popularly know as Mc Burney's incision.

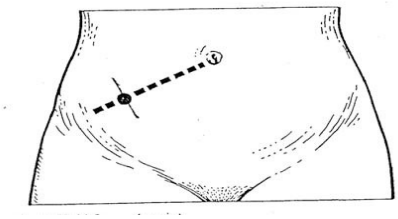


Fig : McBurney's Point

The incision is made at right angles to a line joining the anterior superior iliac spine to the umbilicus, the center, being along the lie at Mc Burney's point. The external oblique is incised in the line of the incision. The fibres of the internal oblique and transverse abdominis

are separated, and after suitable retraction peritoneum is opened. The lowest complication rate is associated with grid-iron incision. It can be converted into a Fowler-Weir incision, by extending the incision inward through the rectus.

Rutherford Morrison's incision: Rutherford Morison's incision is an oblique muscle cutting incision with its lower end at Mc Burney's point and extending obliquely upwards and laterally as necessary. All layers are divided in the same line. The incision is useful, if the appendix is Para or retrocecal and fixed.

Lanz's: This is a small transverse incision put 1 inch medial and above the anterior superior iliac spine and extending up to the lateral border of the rectus sheath. Thereafter the muscles are split as in

grid-iron incision. This method has a definite cosmetic value, extending this incision is difficult

- **Battle's incision:** Battle in 1895, described an incision of variable length in the right semilunar line. This involves the rectus medially. The inferior epigastric vessels are easily avoided, but the vertical peritoneal incision is limited to about two and half inches, if damage to the segmental nerves is to be avoided.

- **Right lower Paramedian:** Is a vertical incision lying parallel to and 1.25 to2.25 cm to the right of the mid line. It commences 2.5 cm below the level of the umbilicus and ends just above the pubis.

The anterior recuts sheath is incised in the line of the incision and the rectus muscle retracted laterally. Transversalis fascia and peritoneum are incised together, the peritoneal cavity being opened through the length of the incision (Care must be taken not to injure the bladder inferiorly).

- **Advantages of this incision:** It gives good access to the pelvic organs in the female and if necessary, it can be readily extended upwards to deal with a perforated duodenal ulcer or other unexpected intra-abdominal pathology.
- **Disadvantage:** The organ is often comparatively inaccessible to this approach.
- **Removal of the appendix:** After opening the abdomen in layers, the abdominal wall along with the peritoneum is lifted up. After removal of pus or serous exudates with a sucker, a pack is inserted to the wound on the medial side using a swab; the caecum is withdrawn. A finger may be inserted into the wound on the medical side to aid delivery of the appendix. Once the appendix has been delivered, then the assistant grasps the caecum. A tissue holding forceps is applied around the appendix. The base of the mesoappendix is clamped with a haemostat, tied and severed.

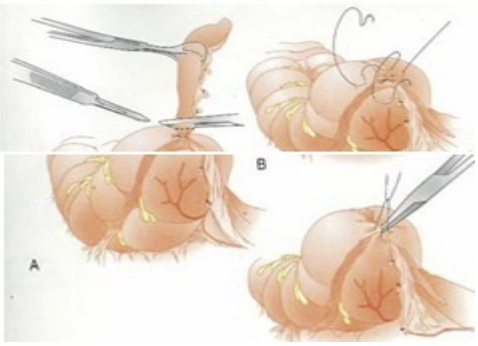


Fig : Steps in Open appendectomy

a. Appendix divided after ligation.

b. Z or purse string stitch is placed in the caecum.

c. Inversion of the appendiceal stump.

- The appendix, now completely freed, base is crushed near its junction with the caecum in a haemostat, which is removed and reapplied just distal to the crushed portion. A catgut ligature is tied around the crushed portion close to the caecum and an atraumatic catgut purse string suture is inserted into the caecum about 1.25 cm from the base. The stich passes through the muscle coat especially picking up the taeniae coli. It is left untied until the appendix has been amputated with a scalpel, below the haemostat. The stump is invaginated while purse string is tied, thus burying the appendix stump.

METHODS TO BE ADOPTED IN SPECIAL CIRCUMSTANCES:

When the caecum cannot be found, caecum has not descended fully or malrotation of the intestine is present, an extension of the incision in an upward direction is indicated. If the appendix cannot be found, make certain that the caecum has been delivered and then trace one of the taenia coli downwards. This must lead to the appendix. Appendix may be buried in the caecal wall or it has become inverted or intussuscepted.

- **The appendix lies buried retrocaecally:** The wound has to be enlarged. The caecum is retracted to the right. Once the Reflection of the peritoneum on the lateral aspect of the caecum is in view, make the hockey stick shaped incision in the parietal peritoneum. After blunt dissection in the retroperitoneal space, the caecum is made more mobile and can be retracted still further, bringing the previously hidden appendix into full view

- **The appendix is clothed with adherent omentum:** Adherent omentum should not be disturbed, it should be divided between haemostats at a convenient distance from the appendix. If the base of the appendix is inflamed; the base must not be crushed for fear of disturbing infection by way of lymphatics or blood stream. It must be ligated close to the wall of the caecum tight enough to obliterate the lumen.

- **The base of the appendix is gangrenous:** Appendix should not be crushed or ligated. Double stitch is placed through the wall of caecum close to base of the gangrenous appendix, which is amputated flush with caecal wall, after which these stitches are tied. Further closure is effected by means of a two layer closure with interrupted seromuscular suture.

- **The appendix has sloughed off:** The mesoappendix anchors the organ in the field of operation. It may, however, be in two portions if a faecolith has perforated through the wall. In such case both portions must be removed and the faecolith retrieved usually from the pelvis.

- **The caecal wall is oedematous:** Invagination should not be attempted, the stump should be ligated and cut surface touched with the diathermy in an attempt to reduce infection.

- **The meso-appendix is gangrenous and cuts out:** If ligature does not hold, a stitch applied directly beneath a spurting vessel may stop bleeding. If the artery has retracted, it must be sought behind the ileum as they take a retrocaecal course.

Retrograde appendectomy :

Employed when the base of the appendix is accessible and difficulty is experienced in identifying or delivering the distal part of the organ completely.

Technique: The base of the organ is divided between two haemostats. The meso-appendix is then clamped and divided working distally. Ligation and in vagination of the stump is done. Gentle traction to the organ will aid in removal of appendix.

Drainage of the peritoneal cavity: If considerable purulent fluid in the retrocaecal space or pelvis is present, or if there is persistant oozing, it is wise to drain the peritoneal cavity.

Drainage of the parities: If there is considerable soiling of the wound, especially in obese and in children, it is indicated 'if in doubt, drain, especially the parities'. (Bailey and Love).

POST - OPERATIVE MANAGEMENT:

- Oral feeds are withheld till the bowel sounds return and flatus is passed.
- IV fluids and electrolyte supplementation is done till oral feeding is resumed.
- Broad spectrum antibiotics are given to cover against mixed intestinal flora, till culture report of the peritoneal exudates is obtained.
- TPR chart 4^{th} hourly
- Analgesic and sedatives are given parenterally.
- If peritoneal drainage has been done, drain removed by 24-48 hours.

- The sutures removed by 7-10 post operative day.

COMPLICATIONS OF APPENDICECTOMY [22,40]

Most of the post-operative complications are not peculiar to appendectomy alone, but may occur with any abdominal operations.

a) Early complications

- Haemorrhage
- Pulmonary complications
- Neurogenic ileus
- Retention of urine

b) Intermediate complications

•Secondary or residual abscess

Pelvic

Paracaecal

Perinephric

Subdiaphragmatic

- Wound infection
- Pyelophlebitis
- Femoral or iliac vein thrombosis

- Phlebitis and pulmonary embolism
- Persistant sinus or fistula

c) Late complications

- Incisional Hernia
- Right sided indirect inguinal hernia
- Intestinal obstruction.

Wound infection is the commonest. The cardiovascular and pulmonary complications occur in the elderly. Wound infection is common in patients with complicated appendicitis. The pus should be cultured and sensitivity done. This will go a long way in treating the infection. Sudden abdominal pain at any time during the first 72 hours after appendectomy may mean either leakage from the stump or slipped ligatures from any artery, both of which are rare, but when it occurs, exploration must be done as and when necessary.

Rupture of caecal wall is rare. It occurs 4 to 6 days after appendectomy. Probably, giving a large enema may cause distension of the gut with the rupture occurring at weak spot. The only hope of saving the patient is by a caecostomy and peritoneal toilet. Treatment of the complications should be done as and when occurs and early.

TREATMENT OF APPENDICULAR ABSCESS:

Two types of appendicular abscess have been described

1) **Recent abscess**

2) **Established abscess**

- **Recent abscess:** Immediate or early operation with or without appendectomy is the treatment of choice for recent abscess and the mobile appendicular mass.

- **Established abscess:** When the abscess is walled off from the surrounding structures, it is an established abscess, and it resolves under adequate treatment with antibiotics.

But conservative management is contraindicated in all children, pregnant women and most elderly patients. Drainage is to be carried out as soon as the patient is fit for operation. In infants, appendectomy should always be done, in addition to the drainage of the abscess because, the conical base, and the broad lumen of the infant appendix promotes continued drainage of the faeces from the caecum through the perforation.

In adults, appendectomy should be done without breaking down adhesions, which have walled off the abscess. If appendectomy is not done at the time of drainage of the appendicular abscess, then interval appendectomy should be done 8 weeks after the drainage

from the abscess has ceased, mass has resolved and the wound has healed.

Systemic antibiotics should be continued for 5 days post operatively and longer, if clinically indicated. Patient can be discharged after a week or so, when he is afebrile and shows no complications secondary to the drained appendicular abscess. The locations of the abscess may be

1. Retrocaecal 60%
2. Pelvic 30%
3. Post ileal 4%
4. Para Colic 4%
5. Others 2%

TECHNIQUE OF DRAINING

• Precaecal, pre-ileal, post-ileal abscess: After the patient has been anaesthetised the surgeon should palpate the swelling. The approach is always trans peritoneal, through an incision made over the most prominent part of the swelling. The index finger passed into the wound and the abscess wall is opened and the pus drained. If the appendix readily comes to hand it should be excised by one of the techniques previously described. Drain is kept through the would and then closed. The drain is left undisturbed for 72 hours.

After this time, it is rotated and shortened daily and removed by the end of the week.

- **Abscess in the retrocaecal space:** employing a retroperitoneal approach can do The drainage. A transverse incision immediately medial to the anterior iliac spine is made. The lateral edge of the peritoneum is exposed, and by stripping it medially with the finger, the mass is reached retroperitoneally. Thus after the procedure, further course is same as for other abscesses.

- **Pelvic abscess:** On rectal examination, a tender warm cystic mass can be felt. When the abscess is pointing through a proctoscope, the abscess is opened with a closed artery forceps at the site of maximum softening. Then a rubber tube drain is kept in the cavity. If the abscess points to the vagina, a posterior colpotomy is done.

CONSERVATIVE REGIMEN OF OCHSNER AND SHERREN:

In 1904, **Ochsner and Sherren** described the conservative line of treatment. They suggested this line of treatment for cases with appendicular mass where the general condition of the patient was satisfactory and the patient presented after 24 hours of the onset of symptoms. It was proposed that with the nature already having localized the lesion, it is unwise to disturb the scene, breaking the barriers. Operations in this case are not only difficult, but also involve more blood loss. Operation may lead to the spread of

infection and prove dangerous. Later faecal fistula may result.

This treatment should be undertaken only in a hospital, where constant care and observation is possible. **"It is not a substitute for operation, it is not a postponement of operation but a preparation for it".** The role of the attending surgeon in such a situation is a **"watchful expectancy and masterly inactivity".** One should be ready to abandon the non-operative regimen if indications arise.

PROCEDURE:

Clinical history of the patient with particular note made of the time of onset of symptoms and diagrammatic recording of the physical signs. A chart with temperature, pulse and respiratory rate is maintained. Patient is kept nil orally and a nasogastric aspiration is instituted to keep the stomach empty.

Parenteral fluid and electrolyte supplementation given. Sedation is withheld. Patient is put on broad spectrum antibiotics. If the bowels do not act normally by 4^{th} or 5^{th} day, a glycerine suppository may be given.

CRITERIA FOR ABANDONING THE REGIMEN

- Rising pulse rate in the early stages.
- Persistent sustained fever over 36 hours.
- Copious gastric aspirate or persistent vomiting.
- Persistent pain.
- Increasing or spreading abdominal tenderness or increase in the size of the mass.
- Fluctuation or rarely oedema, redness of the skin.
- Unrelenting intestinal obstruction.

CONTRAINDICATIONS FOR CONSERVATIVE LINE OF TREATMENT:

- When there is a doubt regarding the diagnosis of acute appendicitis, and other acute abdominal conditions requiring an emergency surgery cannot be ruled out.
- The signs of inflammation are still confined to the appendix
- Acute appendicitis in children below the age of 10 years, or in those over the age of 65 years and in pregnant women.
- **Ochsner and Sherren** suggested interval appendectomy after 3 months. But according to the present consensus, operation can be performed as soon as possible, after complete resolution of the mass has

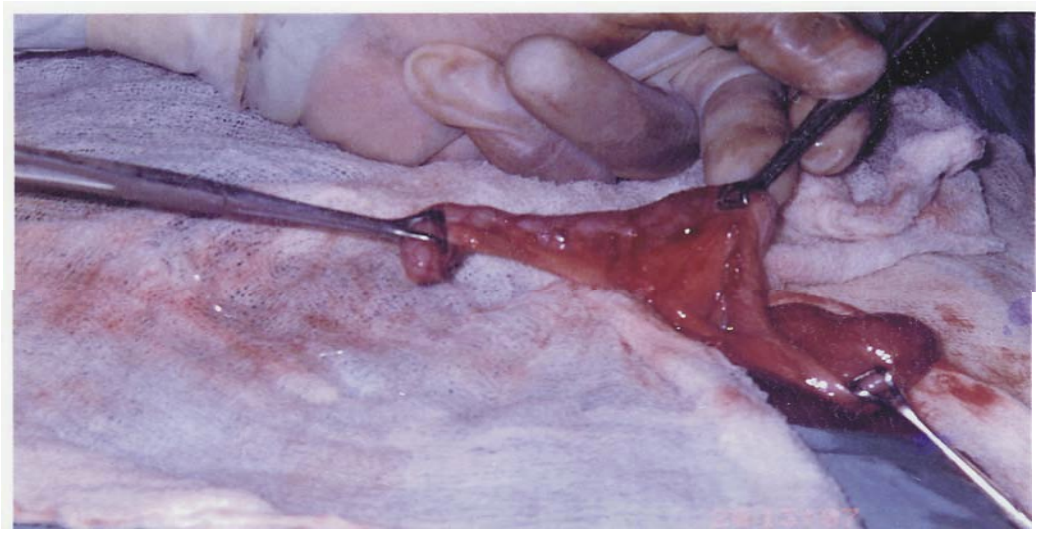
occurred. Today owing to the use of antibiotics and modern supplementary care available, the general opinion is that, the appendix should be removed as soon as the patient can be prepared adequately.

PROGNOSIS

Simple appendectomy in uncomplicated acute appendicitis still carries a mortality approaching 0.2%. Regardless of the phase of the disease, the overall mortality of the primary appendectomy is appreciably under 1%. The average hospital stay approximates 3 days for simple uncomplicated appendectomy. But complications of gangrene and perforation extend the average stays to 7 days.

Anaesthesia, age, affirmity and associated disease influence the outcome with respect to both morbidity and mortality.

Improved surgical techniques, antimicrobials, nasogastric intubation and decompression, pre and post-operative fluid and electrolyte replacement to normal levels, and the application of supportive aids in recovery and intensive care units have contributed appreciably to the reduction in morbidity and mortality from the complications inherent in delayed diagnosis.



INFLAMED APPENDIX FIG.1

INFLAMED APPENDIX FIG.2

MATERIALS AND METHODS

A prospective study of 100 patients who were ill enough to undergo surgery for suspected appendiceal inflammation were admitted to Government Royapettah Hospital under various surgical units was conducted during the period from Jan 2013 to Dec 2013.

A failure of early diagnosis can lead to progression of disease with its attendant morbidity and occasional mortality. In order to achieve accuracy in early diagnosis of Acute Appendicitis a scoring system described by Alvarado[5] was adopted to reduce negative appendicectomy rate with no increase in morbidity and mortality. The scoring system was initially introduced as an adjunct to diagnosis in order to correct a high false positive appendectomy rate.

The scoring system described by Alvarado is based on three symptoms, three signs and two laboratory findings. Patients with a score of 1-4 were not considered likely to have acute appendicitis, those patients with a score of 5-6 were considered to have a possible diagnosis of appendicitis, but not convincing enough to warrant immediate surgery and these were marked for further review. Those with a score of 7-8 were considered to have a probable acute appendicitis and those with a score of 9-10 were considered to have an almost definitive acute appendicitis and submitted to surgery.

In the present study we used modified version of Alvarado score by kalan et al (Kalan et al Ann. R. Coll. Surg. Engg. 1994) by excluding one laboratory finding, shift to the left of neutrophils maturation (score 1) as this is not available on a routine basis and therefore patients were scored out of 9 rather than 10 points.

Depending upon individual presentation of signs and symptoms a score was calculated for each case of suspected acute appendicitis from 9 values. The observed value in each case was added and expressed as end score.

MODIFIED ALVARADO SCORE	
SYMPTOMS	SCORE
1. MIGRATORY RIF PAIN	1
2. ANOREXIA	1
3. NAUSEA VOMITING	1
SIGNS	
1. TENDERNESS RIF	2
2. REBOUND TENDERNESS RIF	1
3. FEVER	1
LABORATORY FINDINGS	
1. LEUCOCYTOSIS	2
TOTAL	**9**

According to the end score.

•Those patients with scores of $\geq$ 7-9 underwent an appendectomy.

•Those Patients with scores of 5-7 who were thought on clinical grounds to require appendectomy were operated accordingly.

•Those patients with score of <5 were observed and managed conservatively and re-assessed.

•Those patients who had mass in RIF were observed and managed conservatively.

All necessary investigations were done in all patients. The cases subjected to emergency surgery were adequately prepared. Whenever vomiting persisted, ryles tube aspiration was done. Parenteral fluids, electrolyte supplementation, broad spectrum antibiotic were administered. Hourly temperature, pulse and respiratory chart were maintained.

Surgery was done under general or spinal anaesthesia. When the diagnosis of acute appendicitis was certain grid-iron incision was employed. Right paramedian incision was used when the diagnosis was doubtful or when frank peritonitis was suspected.

Before resection the appendix was assessed. The specimen of appendix was sent for histopathological examination and the reports analyzed. A study of observations was done and an attempt was made to correlate the clinical presentations with the pathological findings

OBSERVATIONS AND RESULTS

In this series of 100 cases, the patients who presented with acute symptoms and pre-operatively diagnosed to have acute appendicitis were studied.

Table – 4

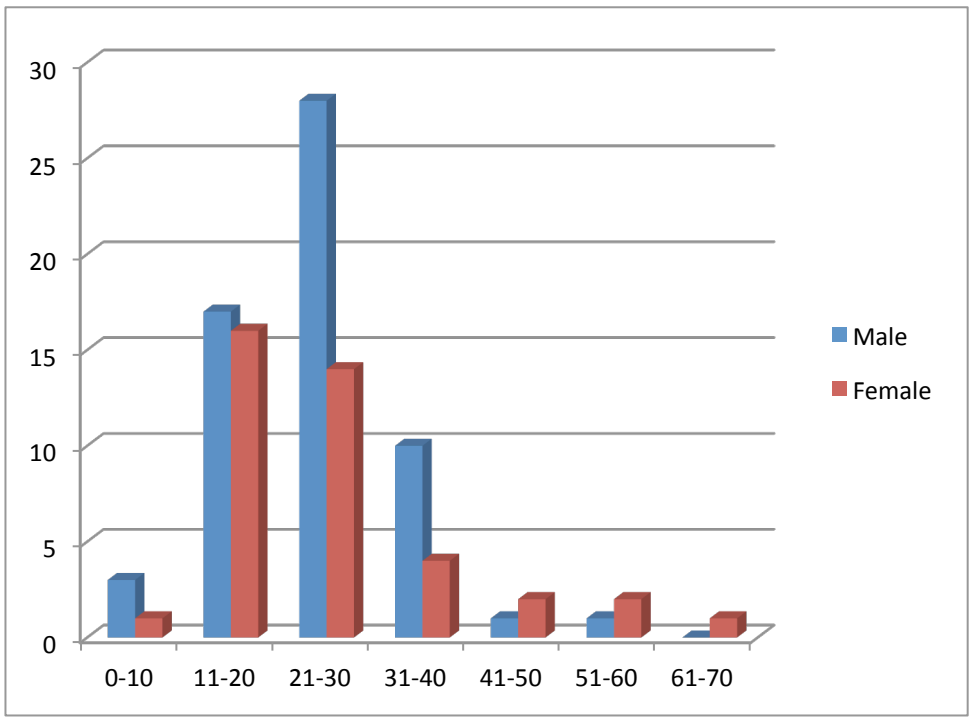
Total Abdominal pain cases suspected to have acute appendicitis	No. of Cases operated	No. of. Operated cases found to have inflamed appendix	Percentage of cases with inflamed appendix
100	80	70	87.5%

Of the 100 cases that were admitted to the Government Royapettah hospital with suspicion of acute appendicitis, 80 cases were taken up for surgery based on the clinical scoring system. Among the 80 cases that were operated 70 cases had acutely inflamed appendix. The percentage of inflamed appendix found on operation was 87.5%.

TABLE - 5 - AGE AND SEX DISTRIBUTION

Age in Years	No. of Cases		
	Males	Females	Total
0-10	3	1	4
11-20	17	16	33
21-30	28	14	42
31-40	10	4	14
41-50	1	2	3
51-60	1	2	3
61-70	0	1	1
TOTAL	**60**	**40**	**0**

Graph



The age group in which acute appendicitis occurred commonly was between11 and 30 years i.e. about 75%, an observation consistent with reports from India. (Dhawan 1962 & Samsi et al. 1969)[44]. It is clear that incidence is less is younger and older age group with peak incidence in second and third decade (Nagar and Kanwar 1983; Shah and Singh 1992). In the present series the males outnumbered females in ratio of 3:2.

In Lewis et al series of 1000 cases the incidence of acute appendicitis was found to occur most commonly in the age group of 20-30 years and male to female ratio was 3:2.

TABLE- 6 - SYMPTOMS

SYMPTOMS	
SYMPTOMS	**PERCENTAGE**
Pain Abdomen	100
Anorexia	70
Nausea	70
Constipation	16
Diarrhoea	6
Burning Micturition	10

Graph

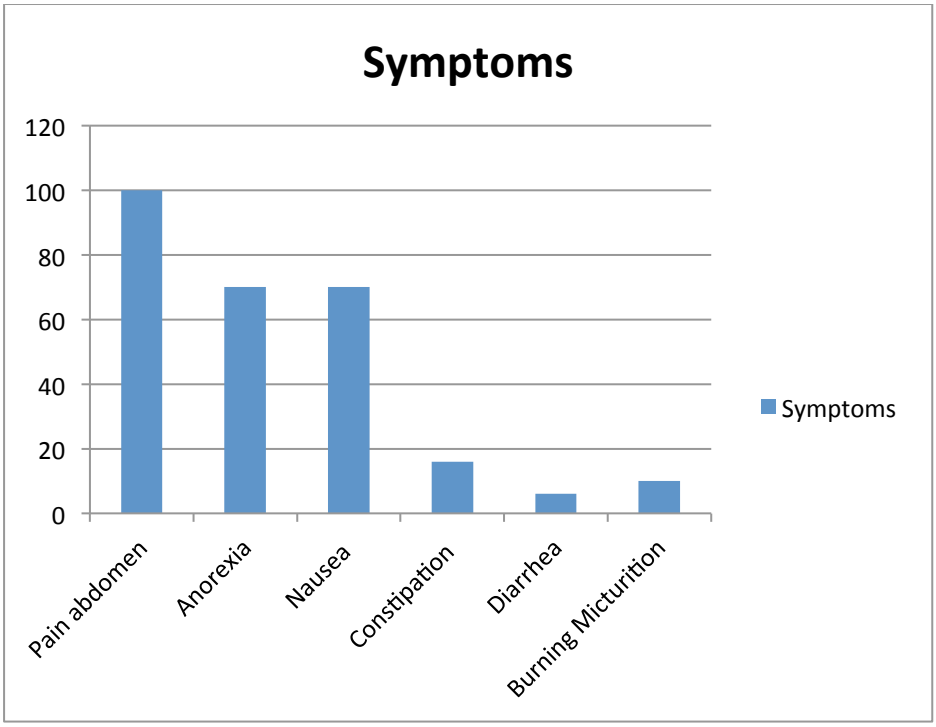
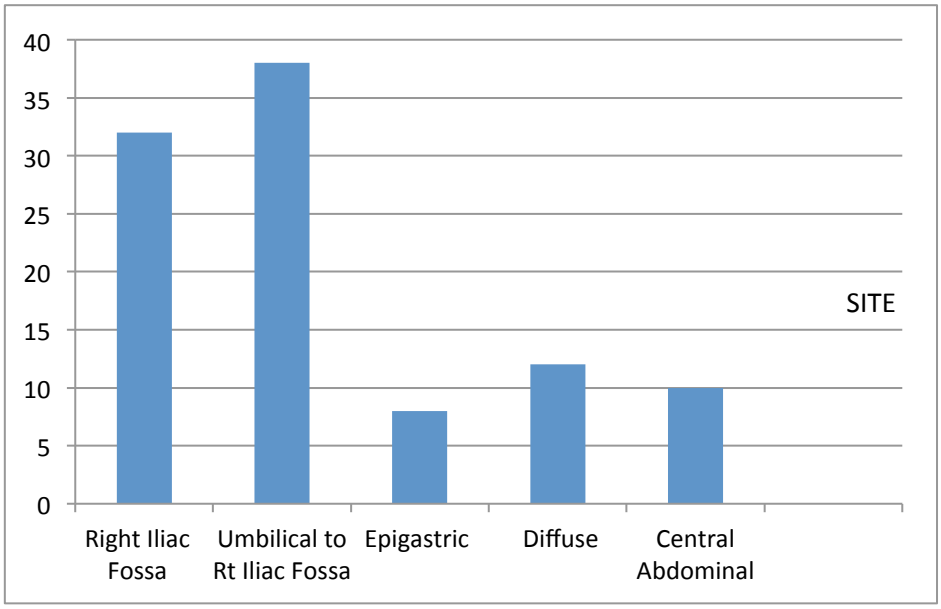


TABLE - 7 : SITE OF PAIN

SITE	PERCENTAGE
Right Iliac Fossa	32
Umbilical to Rt Iliac Fossa	38
Epigastric	8
Diffuse	12
Central Abdominal	10

Graph



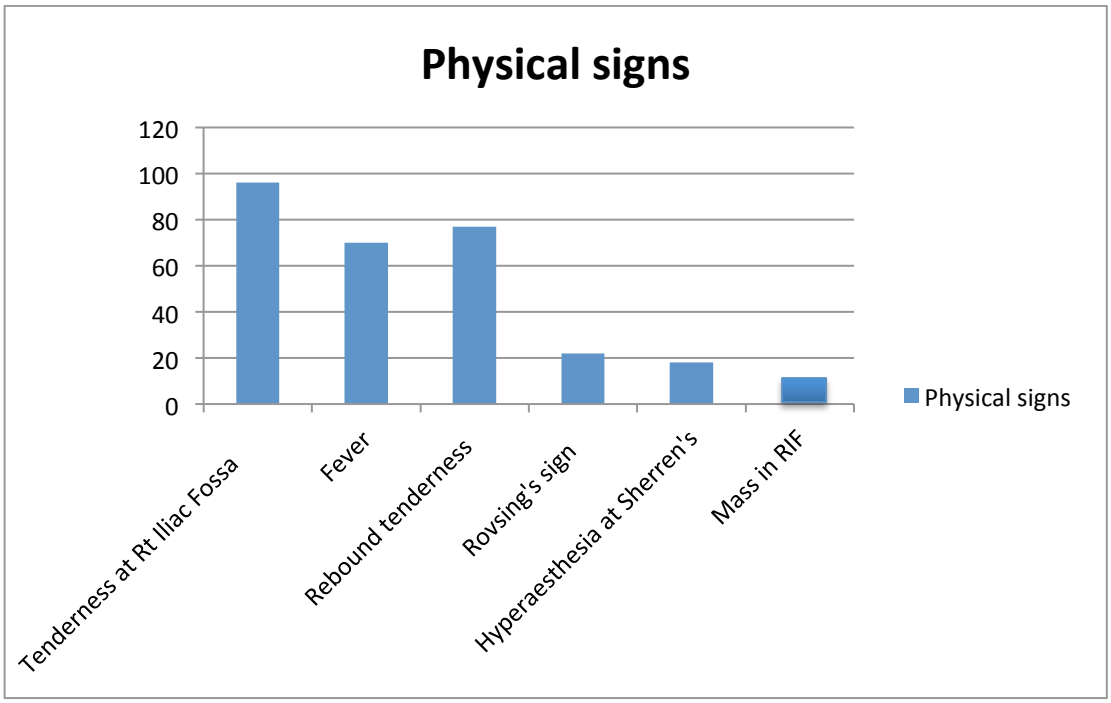
Pain being the commonest symptom at presentation and had been observed in all cases (100%) in the present series. The classical shifting of pain from umbilical to right iliac fossa was present in 38% of cases. Next common symptoms observed were Nausea/Vomiting in 70% case, fever in 64% cases and anorexia 70%. Burning micturition was seen in 10% and bowel disturbance was seen in form of constipation (16%) and diarrhoea(6%). Majority of the patients had aching type of pain and some had colicky pain. Vomiting occurred initially with one or two bouts with or without nausea.

Vomiting appeared after the onset of pain. Fever was of low grade with corresponding rise in the pulse rate. Majority of the patients presented within 24 hrs after onset of pain, most of them presenting between 12-24 hrs after onset of pain.

TABLE - 8 : PHYSICAL SIGNS

SIGNS	PERCENTAGE
1. Tenderness at Rt Iliac Fossa	96%
2. Fever	70%
3. Rebound tenderness	77%
4. Rovsing's sign	22%
5. Hyperaesthesia at Sherren's triangle	18%
6. Mass in RIF	12%

Graph



On clinical examination of the patient, tenderness at Rt Iliac fossa was 96%. It was present when the inflammation was severe. Rebound tenderness was present in 77%.In these cases, there was presence of local peritoneal involvement or when inflamed appendix was more anteriorly placed. Abdominal rigidity (9%) was due to perforated appendix or gangrenous appendicitis. Rovsings sign was positive in 22%.

This sign is often positive whenever inflammation is present in right iliac fossa. Psoas test was positive in 24% of patients whereas obturator test was positive in 15% due to retrocaecal appendix. Hyperaesthesia was present in 18%, 12% of cases had appendicular mass.

TABLE - 9 : Symptomatology and Physical Signs by Campbell & McPhail series

Clinical	Percentage
Abdominal pains :	
Classical	36.5
Central only	18.6
R.I.F.	30.0
Loin	7.0
Vague	7.7
Tenderness maximal in right lower	99.3
Vomiting	52.3
History of previous attacks	39.0
Urinary symptoms	19.3
Diarrhoea	14.0
Muscle-Guarding	76.6
Rebound tenderness	51.7
Rovsing's sign	3.4

Graph

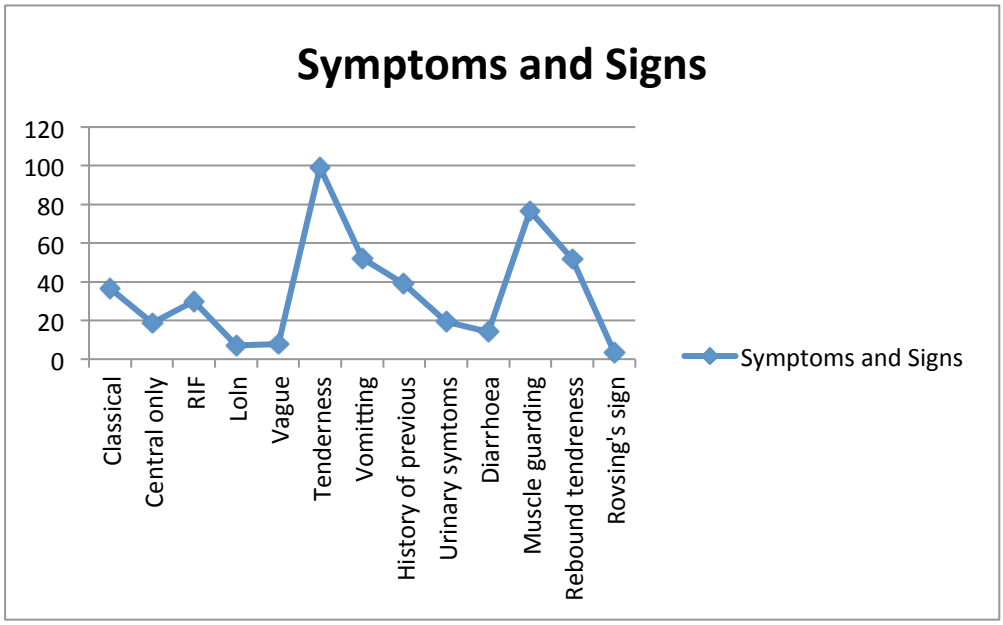
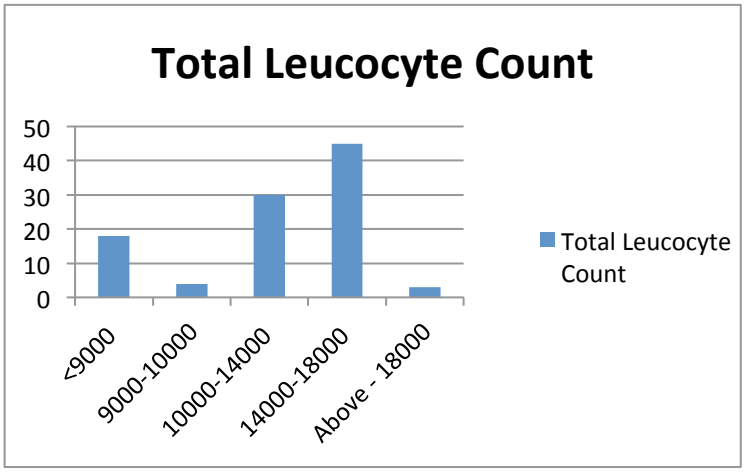


TABLE - 10 : TOTAL LEUCOCYTE COUNT PER MM^3

Total leucocyte count	No. of Cases	Percentage
Per mm^3		
<9000	18	18
9000-10000	04	04
10000-14000	30	30
14000-18000	45	45
Above - 18000	03	03

Graph



In the present study the total leucocyte count was increased in 78%, and it was within normal range in 22%. In Pieper[45] (et al 1992) series, 66% had total count of 11,000 or more. Value of white blood cell count in diagnosis of acute appendicitis is disputed though there is a definite relationship between the severity of the disease on the one hand and leucocytosis on the other hand (Kazarian et al 1970).

URINE ANALYSIS

The Urine microscopic examination in our series showed pyuria in 6% cases and hematuria in 3% cases. In McDonalds (1964) report, microscopic pyuria was present in 19% and hematuria in 5%.

Plain X-ray abdomen

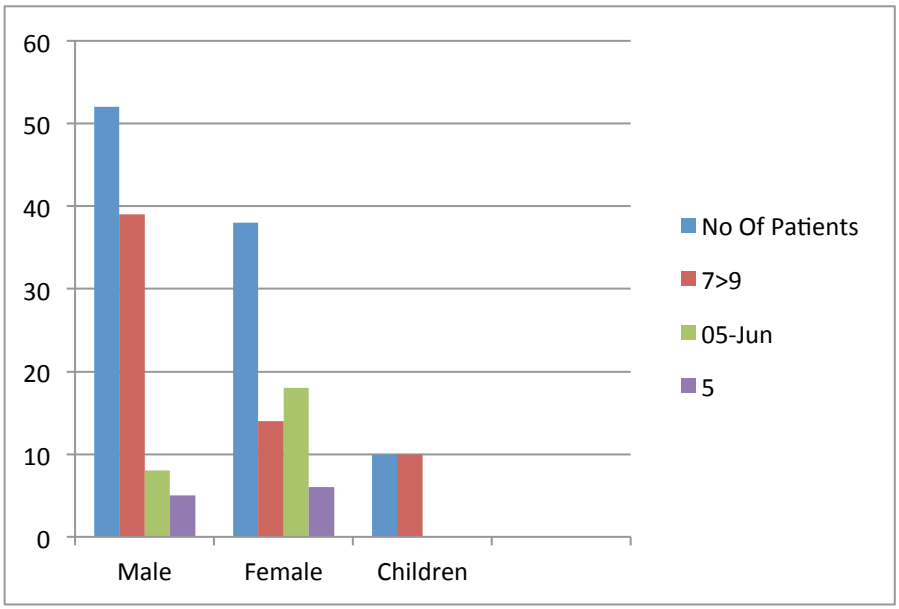
Plain X-ray abdomen was taken in erect posture. Two patients had ground glass appearance suggestive of diffuse peritonitis. Two patients had fluid levels localized to the caecum. Free gas under the diaphragm was not present in the cases with perforated appendicitis. In none of the patient's faecolith casting a radio opaque shadow could be demonstrated.

Table -11:RESULTS OF ALVARADO SCORE

(TOTAL CASES 100)

	No. of Patients	Score			Mass in RIF
		≥7-9	5-6	<5	
MALE	52	39	8	5	7
FEMALE	38	14	18	6	5
CHILDREN	10	10	0	0	0
TOTAL	**100**	**63**	**26**	**11**	**12**

Graph



Results:

Our assessment of patients categorized the patients into three groups viz. male; female; and childrens. Out of 100 cases studied 52 are male; 38 are female and10 are children (<12yr).

Out of 52 male patients, score of ≥ 7-9 were 39; score of 5-6 were 8;5 patients had score<5 and 7 had mass in Right Iliac Fossa.

These 12 patients of score <5 and mass in RIF were observed in hospital and did not undergo surgery. The patients with mass in RIF were advised for interval appendectomy. Out of 38 female patients; score of ≥7-9 were 14; score of 5-6 were 18; score of <5 were 6; and 5 female patients had mass in RIF. These 11 patients of score <5 and mass in RIF were treated and advised on the same line as the male patients. All the 10 children had score of ≥7-9 and were operated upon.

TABLE - 12 : RESULTS OF ALVARADO SCORE (OPERATED -80)

	Number of Patients	Score ≥7-9	Append-icitis	Normal Appendix	Other Diseases
MALE	41	35	34	1	2
FEMALE	29	16	11	5	3
CHILDRE	10	10	0	0	0

TABLE - 12 (a) : RESULTS OF ALVARADO SCORE (OPERATED -80)

	Number of Patients	Score 5-6	Append-icitis	Normal Appendix	Other Diseases
MALE	41	6	5	1	1
FEMALE	29	13	9	4	4
CHILDRE	10	0	0	0	0

TABLES - 13 & 13a

Males with score 7 to 9	
Sensitivity	87.77%
Specificity	50%
Positive Predictive Value	97.14%

Females with score 7 to 9	
Sensitivity	55%
Specificity	44.44%
Positive Predictive Value	68.75%

Operative findings

Total of 80 patients were operated, out of which 41 were males; 29 were females; and 10 were children.

In male patients having score of ≥7-9; 35 patients had Acute Appendicitis; 1 patient had normal appendix and 2 patients had diseases in the form of ileal perforation and Meckel's diverticulitis.

Male patients having score of 5-6 were 6; out of which 5 patients had Acute Appendicitis; 1 patient had normal appendix and1 patient had mesenteric lymphadenitis.

In female patients having score of ≥7-9; 11 had Acute Appendicitis; 5 patients had normal appendix and 3 patients had other diseases, out which 2 had PID;1 had Twisted Right Ovarian cyst; In females with score of 5-6; 9 had Acute Appendicitis; and 4 patients had PID. All the 10 children subjected to operation had Acute Appendicitis.

TABLE - 14 : RESULTS OF ALVARADO SCORE IN KALAN ET AL SERIES

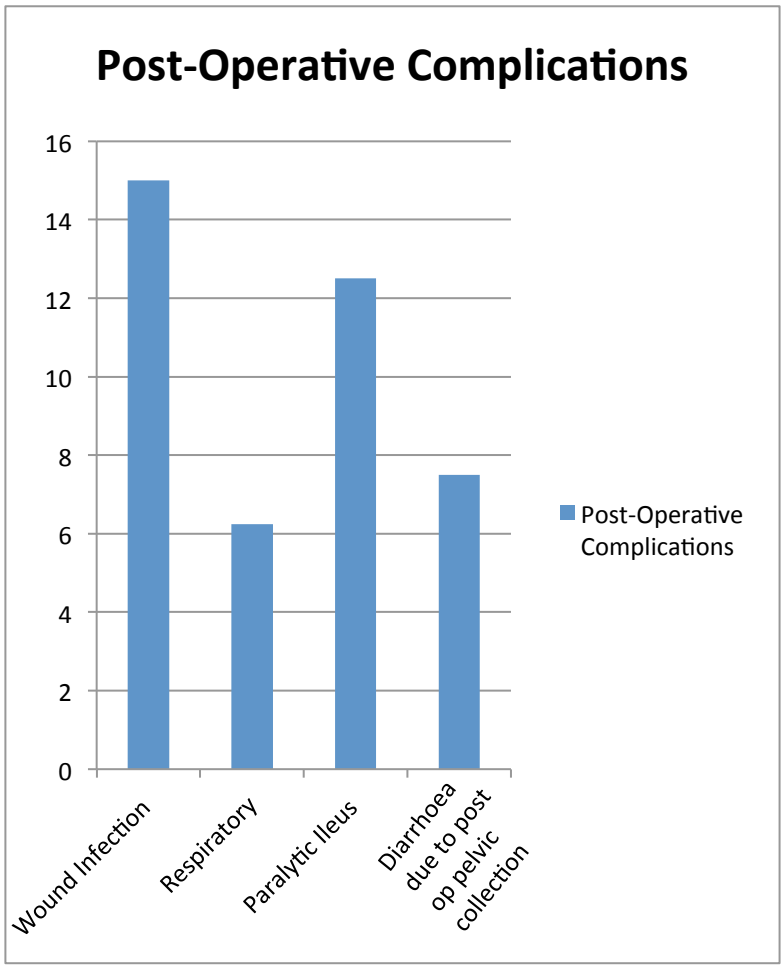
Results of the Alvarado score in Kalan et al series				
	No. of Patients	**Score ≥7**	**Appendicitis**	**Sensitivity**
Men	21	15	14	93%
Women	17	15	10	67%
Children	11	11	11	100%
	No. of Patients	**Score < 7**	**Appendicitis**	**Sensitivity**
Men	21	6	4	67%
Women	17	2	1	50%
Children	11	0	0	0%

The post operative complications, faced in our series are as follows

TABLE - 15 : POST-OPERATIVE COMPLICATIONS

Post-Op. Complications	No.of Patients	Percentage
Wound Infection	12	15%
Respiratory Tract Infection	5	6.25%
Paralytic Ileus	10	12.5%
Diarrhoea due to post op pelvic collection	6	7.5%

Graph



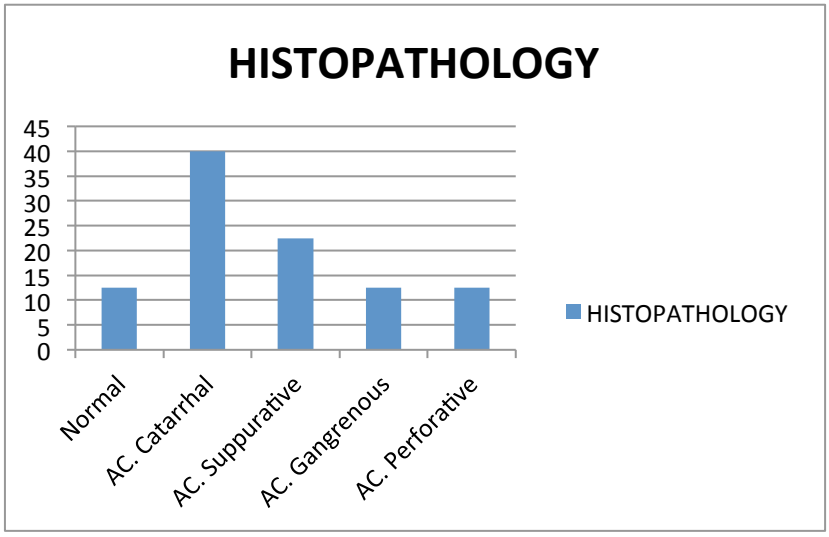
In a series reported by Maddox (1964) the incidence of post-operative complications is 13%.

The pathological diagnosis of the specimen of the appendix sent for histopathological studies are as follow.

TABLE - 16 : HISTOPATHOLOGY

Histopathology	No. of Patients	Percentage
Normal	10	12.5%
AC. Catarrhal	32	40.0%
AC. Suppurative	18	22.5%
AC. Gangrenous	10	12.5%
AC. Perforative	10	12.5%

Graph



DISCUSSION

A study of 100 cases of suspected appendicitis admitted to Government Royapettah Hospital was made between jan 2013 to dec 2013 adopting the modified Alvarado scoring system.

Acute appendicitis remains a common abdominal emergency throughout the world. Though there are lots of advances in the diagnostic field with the invention of sophisticated investigations diagnosis of acute appendicitis remains an enigma for the attendant surgeon. None of the investigations like USG, CT, NMR can conclusively say definitely about appendicitis.

Time and again it has proved that some of the investigations already discussed are costly, time consuming, requiring more specialized and expert services, while some are non feasible and not available every while (Hoffmann; Rasmussen. 1989)[46].

So even today a thorough clinical examination with basic investigation like WBC count remains cornerstone in the diagnosis of Acute appendicitis. With this background many eminent Surgeons & Physicians have been adopting different scoring systems in order to decrease negative appendectomy (Fenyo.G. 1987; Arnbjornsson E. 1985; Teicher et al, 1983)[47].

We find the value of Alvarado score (Alvarado A. 1986), which was modified by Kalan et al 1994 for its routine use in clinical

practice. The modified Alvarado score is simple to use and easy to apply, since it based only on history, clinical examination and a basic laboratory investigations. In our present study, the usefulness of the scoring system was demonstrated beyond doubt by reducing number of negative laparotomies especially in males and children. However in females the negative laparotomy was high and this can be avoided by laparoscopy.

The sensitivity and specificity of modified Alvarado scoring system in our series was as high as 84%. This indicates that by particularly adopting the modified Alvarado scoring system many negative appendectomy can be reduced. Patients in whom the Alvarado score was <5 did not need subsequent appendectomy indicating the usefulness of modified Alvarado scoring system.

In our series when the score was more than 7 indicating strong possibility of intra-abdominal infection localized to the Right Iliac fossa surgery was performed within 6 hours of patient getting admitted to the hospital. The observation was that these patients had badly inflamed appendix with impending perforation once again indicating the sensitivity and specificity of the scoring system.

In patients in whom score was between 5 and 6 were observed for a period of 12-24 hours and re-assessed, where there was persistence of abdominal tenderness with increased WBC count appendectomy was carried out. These patients were also found to

have congested and inflamed appendix.

In our series we had 10 cases of patients in paediatric age group. All of them had score of 7-9 and were operated within 6 hours. Per operative finding was of highly inflamed appendix indicating a sensitivity of 100% in children.

This is important keeping in mind the shortness of omentum in children, which can cause early perforation and peritonitis with its attendant morbidity and mortality (Longino. L et al 1958; Chatterjee 1979).

In our series, we had 28 cases of female patients. Out of 28 cases 16 had score of 7-9 and appendicitis in 11 cases the other being gynaecological causes. Since intra-abdominal infection in females particularly in lower abdomen can be quiet confusing, as it is difficult to differentiate appendicitis from gynaecological condition like twisted ovarian cyst & PID, laparoscopy and abdominal-pelvic USG scan can be advised as a diagnostic tool to minimize negative appendectomy.

CONCLUSION

•The sensitivity of the scoring system in males with score ≥ 7 to 9 is 87.77% & specificity of 50%. Positive predictive value in males is 97.14%.

•The sensitivity of the scoring system in females with score ≥ 7 to 9 is 55%. The specificity of 44.44%. The positive predictive value in females is 68.75%.

•In children the test was very sensitive.

•Alvarado score is very effective in diagnosis of acute appendicitis in children and males but some other diagnostic modality is necessary to ascertain the diagnosis in females along with the clinical scoring system.

•Alvarado scoring significantly reduces negative laparotomies.

•It can work effectively in routine practice as an adjunct to surgical decision making in questionable appendicitis.

•It is simple to use and easy to apply since it relies only on history, clinical examination and a basic laboratory investigation.

•As it is cost effective it can be routinely used in all district general hospital with basic lab-facilities and particularly where facilities of USG scan or CT scan are not available

SUMMARY

In our series a total of 100 cases were included who were suspected of having acute appendicitis.

The results our study are summarized as follows :

1. The total No. of cases operated suspecting acute appendicitis were 80 of which 70 were found to have acutely inflamed appendix.

2. Male patients out numbered female patients in the ratio of 3:2.

3. Most cases of acute appendicitis were found in the age group 11-30.

4. Pain abdomen constituted the most common presenting complaint with almost 100% complaining of it.

5. Anorexia & Nausea were found in 70% of patients.

6. Rt iliac fossa pain was found in 32% of cases with the classical shift of pain in 38%. The rest had central abdomen, epigastric and diffuse abdominal pain.

7. Mild Pyrexia was present in 70% of cases.

8. Most of the signs and symptoms of our present series tallied well with that of Campbell and Mc Phail series reports.

9. Total leucocyte count was elevated in 78% of cases in our present study.

10. The results of Alvarado score applied to patients with typical Rt iliac fossa pain are as follows.

* Total No. of Male patients - 52, of these

- Patients with score 7-9 were 39
- Patients with score 5-6 were 8
- Patients with score < 5 were 5
- Patients with mass in RIF were 7

* Total No. of Female patients - 38, of these

- Patients with score 7-9 were 14
- Patients with score 5-6 were 18
- Patients with score <5 were 6
- Patients with mass in RIF were 5

Total Children were 10 & all were with scores 7-9

11. The results of Alvarado score of operated patients are as follows:

Total case operated were 80, 61 patients had score 7-9, 19 patients had score 5-6. -

* The positive predictive value in Males was 97.14%

* The positive predictive value in Females was 68.75%.

12. Patients with end score < 5 were kept under observation. None of the patients required surgery.

13. All patients with appendicular mass were managed conservatively and advised for interval appendectomy after 6-8 weeks.

14. Most commonest incision used was Grid Iron in 74% of cases with 6 patients required Rt lower paramedian incision. Most cases were done under spinal anaesthesia.

15. The post operative complications seen in our patients were mainly wound infection (in 15%). Diarrhoea due to post op pelvic collection was noted in 7.5% and paralytic ileus in 12.5%.

16. Histopathological examination of the resected appendix proved acute catarrhal type to be predominant (40%).

(ANNEXURE – I)

BIBLIOGRAPHY

1. Addiss DG, Shaffer N, Fowler BS, et al : The epidemiology of appendicitis

and appendectomy in the united states Am J. Epidemiol 132:910, 1990.

2. Korner H; Sondenna K, Soreide JA, et al: Incidence of acute non perforated

and perforated appendicitis: Age-Specific and sex specific analysis; world J surg 21; 313, 1997.

3. Flum DR, koepsell, et al : Has misdiagnosis of appendicitis decreased over

time? A population Based analysis. Arch surg 137: 799; 2002.

4. Flum DR, Koepsell T; The clinical & economic correlates of misdiagnosedappendicitis : Nationwide analysis, Arch surg 137: 799; 2002.

5. Alvarado A: A practical score for the early diagnosis of acute appendicitis.

Ann Emerg Med 15.557, 1986.

6. Ellis H: Appendix, in Schwartz SI(ed): Maingot's abdominal operations, 8th edition vol.2 Norwalk: Appleton-century - crofts 1985 P 1255.

7. Lewis F: Appendix, in Davis JH (ed): clinical surgery vol.1 St louis:Mosby, 1987, p1581.

8. Fitz RH: Perforating inflammation of the vermiform appendix with specialreference to its early diagnosis and treatment. Trans Assoc Am physicians 1:107, 1886.

9. Mc Burney C: Experience with early operative interference in cases ofdisease of the vermiform appendix. Ny state med J 50: 676; 1889.

10. Mc Burney C; The incision made in the abdominal wall in cases of appendicitis; Ann surg 20: 38, 1894.

11. Semm k; Endoscopic appendectomy, Endoscopy 15:59; 1983.

12. Addiss DG, Shaffer N, Fowler BS et al: The epidemiology of appendicitis and appendectomy in the US. Am J Epidemiol 132: 910, 1990.

13. Hale DA, Molloy M, Pearl RH, et al: Appendectomy: A contemporary Appraisal. Ann Surg 225: 252, 1997.

14. Buschard K, Kjaeldgaard A; Investigation and analysis of the position, fixation, length & Embryology of the vermiform appendix. Acta chir Scand 139: 293, 1973.

15. Skandalakis Jt, Gray SW, Ricketts R; The colon and rectum in skandalakis JE, Gray Sw(eds): Embryology for surgeons. Baltimore: Williams and Wilkins, 1994 p242.

16. Russel RCG, Williams NS and Bullstrode Christopher JK; Bailey and love short practice of surgery. Arnold publishers 24th ed 2004 (1203-1218).

17. Ajmani ML, Ajmani K: The position, length and arterial supply of vermiform appendix. Anat Anz 153; 369, 1983.

18. Peter L. Williams, Roger Waswik, Gray Anatomy, chruchill living stone Inc. 36th edition 1984, (1353-1354).

19. Burkitt P. The aetiology of appendicitis. Br J Surg 58 ; 695; 1971.

20. Butler C: surgical pathology of acute appendicitis Hum pathology 12,870, 1981.

21. Miranda R. Johnston AD, O leary JP; Incidental appendectomy frequency of pathologic abnormality Ann Surg 46; 355.1980.

22. Richard A Williams and Paul myers - Micrograph pathology of the appendix, first edition, chapman/ Hall inc 1994.

23. David CH. Sabiston, JR-Acute appendicitis in - The text book of surgery, WB Saunders international, 15th edition 1997: 964-970.

24. Brunicardi FC; Dunn DL, Hunter JG and Pollock RE, Anderson DK, Billiar T.R., Schwartzi's priciples of surgery Mc Graw Hill companies, Inc; 8th edition, 2005 pp1119-1135.

25. Stanley L, Robbins et al Basic pathology WB Saunders international 5th ed 1994; 519-50.

26. Russel RCG, Williams NS& Bullstrode Christopher JK. Bailey & love short practice of surgery. Arnold publishers 24th ed 2004; 1203-1218.

27. Schwartz SI; Appendix, in Schwartz SI, Shires GT, Spencer Fc(eds): Principles of Surgery: 5th ed Vol. 2 Newyork: Mc Graw Hill, 1989, P 1315.

28. Bower RJ; Bell MJ, Terhberg JL; Diagnostic value of the white cell count and neutrophil percentage in the evaluation of abdominal pain in children surg Gynecol obstret 152; 424, 1981.

29. Graham JA, urinary cell counts in appendicitis scott med J 1965; 10:126.

30. Smith DE, Kivchmer NA, steward DR; use of Barium enemas in the diagnosis of acute appendicitis and its complications Am. J surg 138: 829, 1979.

31. Rajagopalan AE, Mason JH, Kennedy N, Pawlikowski J. The value of Barium enema in the diagnosis of acute appendicitis. Arch surg 1977; 112: 531-533.

32. Fedshin P, Kelvin FM, Rice RP, non specificity of Barium enema findings in acute appendicitis. AJR 1984; 143, 99-102.

33. Jeffery RB, Jain KA, Nghiem HV; sonographic diagnosis of acute appendicitis. Interpretive pitfalls Am J Roentgenol 162:55, 94

34. Puig S, Hormann M, Rebhandl W, et al: Ultrasound as a primary diagnostic tool in relation to negative appendectomy: six years experience Radiology 226. 101, 2003.

35. Raman SS, LU DSK, Kadell BM et al : Acuracy of non focussed helical CT for diagnosis of acute appendicitis A 5years Review. Am J Roentgenol 178: 1319, 2002.

36. Stroman DL, Bayouth CV, Kuhn JA, et al: The role of computedtomography in the diagnosis of acute appendicitis. Am J surg 178: 485,1999.

37. Fuchs JR, schlamberg JS, short sleeve MJ, et al: Impact of abdominal CT imaging on the management of appendicitis an update J Surg Res 106: 131, 2002.

38. Diehl JT, Eisental MS, Gilinov, Rao-D. The role of peritoneoscopy in the diagnosis of acute abdominal conditions. cleve clin Q 1981; 48: 325-330.

39. Devtsch AA, Zelikovsky A, Reiss R et al. Laparoscopy in the prevention of unnecessary appendectomy. A prospective study Br. J. Surg 1982; 69, 336-337.

40. Zinner Michael J; Schwartz Seymour I, Ashley Sw, Ellis H, Mc Fadden DW. "Maingot's abdominal operations" Mc grawhill 10th edition 2001.

41. Ashley, J. B.D.: observations on the epidemiology of appendicitis Gut 533, 1967.

42. Agrawal, SK and Nan, A.K.: Appendectomy: A surgicopathological study of 100 caes J. Ind Med. Assoc; 51:59, 1968.

43. Burkitt, D.P. : The aetiology of appendicitis Br J Surg, 58: 695, 71

44. Dhawan R: Appendicitis in rural practice observation in 100 cases J. Ind med. Assoc., 39: 514, 1962.

45. Pieper R, Kaer L, Nasman P. Acute appendicitis a clinical study of 1018 cases of emergency appendectomy. Acta chir scandinavica.

46. Hoffman LO, Rasmussen DO. Aids in the diagnosis of acute appendicitis Br J Surg 1989: 76; 774-9.

47. Fenyo G. Routine use of a scoring system for decision making in suspected acute appendicitis in adults. Acta chir scandinavica1987; 153; 345-51.

48. Lewis FR, Hokroff JW, Boey et al Appendicitis a clinical review of the diagnosis and treatment in 1000 cases. Arch surg 1975: 110: 677-684.

49. Doms et al : ultrasonography in the diagnosis of acute appendicitis Br. J Surg 1991; 78: 315-318.

50. Gronroos JM, Forstrom JJ, Irjale K; phospholipase A_2, CRP & WBC count in the diagnosis of acute appendicitis. clin. Chemistry 1994; 40: 1757-1760.

ANNEXURE - II

PROFORMA

NAME : D.O.A.

AGE : D.O.O.

SEX : D.O.D.

OCCUPATION :

ADDRESS :

¾ CHIEF COMPLAINTS:

1. PAIN
2. VOMITING / NAUSEA
3. FEVER
4. DIARRHOEA/CONSTIPATION
5. DISTENSION OF ABDOMEN
6. OTHER COMPLAINTS

HISTORY OF PRESENTING COMPLAINTS:

- **PAIN :**

b) DURATION

c) TIME & MODE OF ONSET

d) SITE OF PAIN : RIF/EPIGASTRIC/PERIUMBILICAL/DIFFUSE

e) SHIFTING OF PAIN

f) MIGRATION OR RADIATION OF PAIN

g) CHARACTER OF PAIN

h) AGGRAVATING FACTORS

i) RELIEVING FACTORS

VOMITING

a) DURATION

b) ITS RELATION TO PAIN

c) FREQUENCY AND QUANTITY

d) CHARACTER : PROJECTILE, EFFORTLESS.

e) COLOR AND NATURE OF VOMITUS.

FEVER :

MILD, MODERATE, SEVERE

CONTINOUS, INTERMITTENT, REMITTENT

BOWELS :

DIARRHOEA

CONSTIPATION

TENESMUS

MICTURITION :

PAINFUL, FREQUENCY, BURNING,

QUANTITY, COLOR

HISTORY OF INGESTION OF PURGATIVES OTHER COMPLAINTS.

PAST HISTORY :

HISTORY OF SIMILAR ATTACKS : DURATION

TREATMENT TAKEN

HISTORY OF PREVIOUS OPERATIONS OR ANY ABDOMINAL DISEASES:

PAST HISTORY SUGGESTIVE OF :

HYPERTENSION, DIABETIS, TUBERCULOSIS

PERSONAL HISTORY:

DIET : VEGETARIAN/MIXED.

ANY ADDICTIONS: SMOKING, CHEWING TOBACCO OR PAN, CONSUMPTION OF ALCOHOLIC BEVERAGES,

BOWEL HABITS :

MICTURITION:

SLEEP :

FAMILY HISTORY

MARITAL STATUS

ANY FAMILY MEMBERS SUFFERED SIMILAR ILLNESS.

MENSTRUAL HISTORY:

AGE OF MENARCHE

HISTORY SUGGESTIVE OF DYSMENORRHOEA

L.M.P.

HISTORY OF ANY VAGINAL DISCHARGE

PHYSICAL EXAMINATION :

•GENERAL SURVEY

•BODY BUILD & NOURISHMENT

•APPEARANCE

•ATTITUDE : RESTLESS/QUITE

•DEHYDRATION: MILD/MODERATE/SEVERE/NIL

•ANAEMIA/JAUNDICE/CYANOSIS/CLUBBING OF NAILS

GENERALISED LYMPHADENOPATHY/ PEDAL ODEMA.

PULSE

TEMP.

•RESPIRATORY RATE.

•BLOOD PRESSURE

LOCAL EXAMINATION :

EXAMINATION OF ABDOMEN

INSPECTION

CONTOUR OF ABDOMEN

POSITION OF UMBILICUS

MOVEMENTS WITH RESPIRATION

ANY OPERATIVE SCAR

VISIBLE SWELLING

FLANKS

SPINE

EXTERNAL GENITALIA

HERNIAL ORIFICES

PALPATION

LOCAL RISE OF TEMPERATURE

HYPERAESTHESIA AT SHERREN'S TRAINGLE

TENDERNESS AT Mc BURNEY'S POINT

DEGREE AND EXTENT OF TENDERNESS

REBOUND TENDERNESS

ROVSING'S SIGN

COPE'S PSOAS TEST

COPE'S OBTURATOR TEST BALDWIN'S TEST

RIGIDITY

MUSCLEGUARDING

ANY PALPABLE MASS

PALPATION OF HERNIAL SITES

EXTERNAL GENITALIA

LIVER/SPLEEN/KIDNEY

PERCURRSION

PERCUSSION NOTE; RESONANT, DULL, TYMPANIC, SHIFTING

DULLNESS, FLUID THRILL

LIVER DULLNESS

RENAL ANGLES; DULL/RESONANT

AUSCULTATION

BOWEL SOUNDS

- RECTAL EXAMINATION
- VAGINAL EXAMINATION
- GENERAL EXAMINATION
- CARDIOVASCULAR SYSTEM
- RESPIRATORY SYSTEM
- CENTRAL NERVOUS SYSTEM
- URINARY SYSTEM

INVESTIGATIONS

BLOOD;

HB%, D.L.C., T.L.C., B.T., C.T., BLOOD GROUP.

URINE :

ALBUMIN, SUGAR, MICROSCOPIC EXAMINATION

PLAIN X-RAY ABDOMEN IN ERECT POSTURE

ULTRASONOGRAPHY; ABDOMEN/PELVIS, OTHERS

***DIAGNOSIS**

***MANAGEMENT: SURGICAL**

PRE-OPERATIVE INSTRUCTIONS

TYPE OF ANAESTHESIA

TYPE OF INCISION

POST-OPERATIVE INSTRUCTIONS

POST-OPERATIVE PERIOD

POST-OPERATIVE COMPLICATIONS MANAGEMENT

CONSERVATIVE

CHARTS

DIET

DRUGS

INTRA-VENOUS FLUIDS.

KEY TO MASTER CHART

IP - In patient Number

M/F - Male/Female

AP - Abdominal Pain

Mig./RIF - Migratory Right iliac fossa pain

Anor - Anorexia

N/V - Nausea / Vomiting

RIF/T - Right Iliac fossa tenderness

RE/T - Rebound Tenderness

Fev - Fever

AS - Alvarado Score

Per op. find - Per Operative Findings

HPE - Histopathological Examination

Post op. Find - Post operative findings

O/S - Obturator Sign

R/S - Rovsing's sign

R/T - Rectal tenderness

Mass - Mass in Rt iliac fossa

P/S - Psoas Sign

NA - Normal appendix

PID	-	Pelvic inflammatory disease.
ACA	-	Acute Catarrhal appendix.
AGA	-	Acute Gangrenous appendix
ASA	-	Acute Suppurative appendix
APA	-	Acute perforative appendix
WI	-	Wound infection
PI	-	Paralytic ileus
D	-	Diarrhoea
RTI	-	Respiratory Tract infection
H	-	Hyperaesthesia
I.Perf	-	Ileal perforation
MD	-	Meckle’s diverticulitis
WBC	-	White blood cell count.

MASTER CHART

SR. NO.	IP	NAME	AGE	SEX	MIG/ RIF	ANOR	N/V	RIF/T	RE/T	FEV.	OTHERS	WBC	AL.SC	PER.OP.FIN	HPE.	POST-OP
1.	299	Kanish Fathima	27	F	1	0	0	2	1	1	O./S	14900	7	A.A.	A.C.A.	-
2.	242	Mahalakshmi	19	F	1	1	1	2	1	1	-	13400	9	A.A.	A.S.A.	P.I.
3.	351	Sathish	09	M	0	1	1	2	1	1	R/S	11700	8	A.A.	A.G.A.	W.I.
4.	831	Abbas	23	M	1	1	1	2	1	1	R/T	6400	7	A.A.	A.C.A.	-
5.	834	Rajiv	18	F	1	1	1	2	1	1	P/S	12600	9	A.A.	A.S.A.	P.I.
6.	389	Kavitha	14	F	1	1	1	2	1	1	O/S.H	9800	7	A.A.	A.S.A.	-
7.	468	Surya Narayanan	28	M	0	0	1	2	1	1	MASS	13500	7	A.A.	A.S.A.	-
8.	480	Ramesh	60	M	0	1	1	2	1	1	R/S.H	16000	8	A.A.	A.P.A	W.I./P.I.
9.	950	Shahul Hameed	26	M	1	1	1	2	1	1	R/T	5800	7	A.A.	A.C.A.	-
10.	728	Mohanapriya	23	F	0	1	1	2	1	0	P/S	12900	7	RT. TW .OV. CYST	N.A.	-
11.	912	Karthika	09	F	0	1	1	2	1	1	R/S.H	16400	8	A.A.	A.S.A.	-
12.	1362	Nohanapriya	21	F	1	1	1	2	1	1	R/T	12400	7	A.A.	A.C.A.	-
13.	1509	Nazir	38	M	0	1	1	2	1	1	P/S	11800	7	A.A.	A.S.A.	-
14.	2018	Vinayagamoorthy	17	M	0	1	1	2	1	1	R/S.H	12600	8	A.A.	A.P.A.	W.I./D
15.	2101	Thamizh	18	F	1	1	1	2	1	0	R/T	14000	5	A.A.	A.C.A.	-
16.	2104	Thamizh	31	M	0	1	1	2	1	1	O/S.H	12400	8	A.A.	A.P.A.	D
17.	1972	Viji	32	F	1	0	0	1	1	1	P/S	15300	5	A.A.	A.C.A.	-
18.	2225	Yuvaraj	26	M	0	1	1	0	1	0	MASS	-	3	-	-	-
19.	2299	Mehala	23	F	1	0	0	2	1	1	R/S	6200	5	-	A.C.A.	-
20.	2290	Kalpanadevi	25	F	0	1	1	2	1	0	O/S	14300	5	P.I.D.	N.A.	-
21.	2507	Ammasi	19	M	0	-	-	2	-	1	R/S	-	3	-	-	-
22.	2634	Syed Ali Fathima	30	F	0	1	0	2	0	0	P/S	12700	5	A.A.	A.S.A.	-
23.	2578	Velu	40	M	1	1	1	2	1	1	O/S	8300	7	A.A.	A.C.A.	R.P.I.
24.	2594	Akshaya	36	F	1	0	0	2	0	0	P/S	11100	5	A.A.	A.C.A.	-
25.	2766	Babu	19	M	0	1	1	2	1	0	R/S	15500	7	A.A.	A.G.A.	R.T.I.

SR. NO.	IP	NAME	AGE	SEX	MIG/ RIF	ANOR	N/V	RIF/T	RE/T	FEV.	OTHERS	WBC	AL.SC	PER.OP.FIN	HPE.	POST-OP
26.	2605	Harini	25	F	0	1	1	2	1	1	R.T.	9100	6	P.I.D.	N.A.	-
27.	2708	Samuel	22	M	1	0	0	2	1	1	R.S.	11200	7	A.A.	A.C.A.	-
28.	2815	Suganthan	30	M	0	1	1	0	1	-	-	-	3	-	-	-
29.	3155	Nasir	12	M	1	1	1	2	1	1	OS/H	14400	8	A.A.	A.G.A.	R.T.I./D
30.	3404	Arul Pandian	22	M	1	0	1	2	1	1	R/S	14600	8	A.A.	A.C.A.	-
31.	3715	Vinoth	22	M	0	1	1	2	1	1	P/S	15200	8	A.A.	A.G.A.	-
32.	3734	Zakir	30	M	0	1	1	2	1	1	MASS	11800	8	-	-	-
33.	3768	Jayasuriya	28	F	0	1	1	2	1	1	P/S	17700	7	A.A.	A.G.A.	-
34.	3787	Lakshmi	25	F	0	1	1	2	1	1	-	16500	8	A.A.	A.S.A.	W.I.
35.	3835	Sakthivel	15	M	1	1	1	2	0	0	O/S	15500	7	A.A.	A.G.A.	-
36.	3901	Ananthi	10	F	0	1	1	2	1	1	R/T	14300	8	A.A.	A.P.A.	-
37.	3895	Dinesh	24	M	1	1	1	2	1	1	H	12600	5	A.A.	A.C.A.	W.I.
38.	3971	Sitha	20	F	0	0	0	2	1	1	R/S	7600	3	A.A.	A.C.A.	-
39.	4109	Rajesh	26	M	0	1	1	2	1	1	MASS	6200	6	-	-	-
40.	4184	Arjun	15	M	0	0	1	2	1	1	-	17700	7	A.A.	A.S.A.	-
41.	4201	Pavithran	21	M	0	1	1	2	1	1	O/S.H	19900	8	A.A.	A.P.A.	P.I./D
42.	4346	Mobina	18	F	1	1	1	2	1	1	R/P	8100	7	A.A.	A.C.A.	-
43.	4344	Shiva	30	M	0	1	1	2	1	0	R/S	18800	7	A.A.	A.S.A.	-
44.	4454	Mohammed	25	M	0	1	1	2	1	1	P/S	11900	7	MECK.DIVERT.	N.A.	W.I.
45.	4659	Bharath	35	M	1	1	1	2	1	1	H	13200	9	A.A.	A.S.A.	-
46.	4683	Komala	25	F	0	0	0	2	1	0	MASS	14100	5	A.A.	A.C.A.	-
47.	4741	Rajkamal	18	M	1	1	1	2	1	1	P/S	15300	9	A.A.	A.C.A.	R.T.I.
48.	4817	Maharajan	26	M	0	1	1	2	0	1	O/S. RT	6200	5	A.A.	A.C.A.	-
49.	4909	Haribabu	26	M	1	1	1	2	1	1	R/S	14200	9	A.A.	A.C.A.	P.I.
50.	5300	Sharmila	26	F	0	1	1	2	0	0	H	5400	4	PID	N.A.	-

SR. NO.	IP	NAME	AGE	SEX	MIG/ RIF	ANOR	N/V	RIF/T	RE/T	FEV.	OTHERS	WBC	AL.SC	PER.OP.FIN	HPE.	POST-OP
51.	2889	Thinku	22	M	1	1	1	2	1	1	R/S	6200	7	A.A.	A.C.A.	P.I.
52.	5449	Vijayalakshmi	22	F	0	1	1	2	1	1	R/T	14300	6	P.I.D.	-	-
53.	5446	Dhanam	22	F	1	0	1	2	1	1	O/S.H	17550	8	A.A.	N.A.	WI
54.	5843	Amudha	12	F	0	1	1	2	1	1	-	16200	8	A.A.	A.G.A.	-
55.	5724	Sakthi	30	F	0	1	1	2	1	1	MASS	11400	8	A.A.	A.S.A.	RTI
56.	5755	Santhoshini	14	F	1	1	0	2	0	0	P/S	12300	7	A.A.	A.C.A.	-
57.	5774	Saravanan	24	M	0	1	0	2	1	0	H	7400	3	-	-	PI
58.	5808	Sasi	10	M	0	1	1	2	1	1	R/T	16500	8	A.A.	A.P.A.	D
59.	5838	Mansoor	20	M	0	1	1	2	1	0	MASS	17200	7	-	-	-
60.	5881	Sadik	26	M	1	1	1	2	1	1	P/S	17100	9	A.A.	A.C.A.	-
61.	6277	Suganthy	19	F	0	1	1	2	1	0	R/S	15400	7	A.A.	A.C.A.	-
62.	6387	Thaman	14	M	0	1	1	2	1	1	H	13200	8	A.A.	A.G.A.	-
63.	6229	Nalini	32	F	0	1	1	2	1	0	O/S. R/T	12500	8	A.A.	A.C.A.	-
64.	7108	Kumaresan	25	M	1	0	0	2	1	1	P/S	11700	7	A.A.	A.S.A.	-
65.	6552	Vinoth	11	M	0	1	1	2	1	1	H	16300	8	A.A.	A.S.A.	-
66.	6619	Surendran	09	M	0	1	1	2	1	1	R/S	14300	8	A.A.	A.P.A.	WI
67.	6618	Pavithra	28	F	1	0	0	2	0	0	MASS	16500	5	A.A.	A.C.A.	-
68.	6638	Mohanasunda	21	M	0	0	1	2	1	1	RT	9600	7	A.A.	A.S.A.	PI
69.	6657	Mallika	16	F	1	1	0	2	1	1	O/S	8400	6	A.A.	A.C.A.	RTI
70.	6736	Anish	18	F	0	0	1	2	0	0	-	1190	3	-	-	-
71.	6838	Srinisha	34	F	0	0	0	2	1	0	R/S.H	16000	5	MES. LYM	-	-
72.	7098	Durairaj	31	M	1	1	1	2	1	1	P/S	15600	9	A.A.	A.G.A.	WI
73.	7192	Yashoda	41	F	0	0	0	2	0	1	O/S	14800	5	A.A.	A.C.A.	-
74.	2157	Indran	38	M	1	1	1	2	1	1	P/S	6600	7	A.A.	A.S.A.	-
75.	7194	Dhivya	16	F	1	0	0	2	1	1	MASS	12500	5	A.A.	A.C.A.	RTI

SR. NO.	IP	NAME	AGE	SEX	MIG/ RIF	ANOR	N/V	RIF/T	RE/T	FEV.	OTHERS	WBC	AL.SC	PER.OP.FIN	HPE.	POST-OP
76.	7232	Pugazhenthi	24	M	0	0	1	2	1	1	N/S	11600	7	A.A.	A.S.A.	-
77.	7236	Rajan	22	M	0	1	1	2	1	1	H	12500	8	A.A.	A.G.A.	-
78.	7364	Sharma	20	M	1	1	1	2	0	0	MASS	16600	7	A.A.	A.C.A.	-
79.	7365	Rajan	19	M	0	1	1	2	0	1	H	15400	7	A.A.	A.S.A.	-
80.	7339	Kamaraj	21	M	0	1	1	2	1	1	R/S	15400	8	A.A.	A.P.A.	W.I.
81.	7444	Munuswamy	11	M	0	1	1	2	1	1	P/S	12600	8	A.A.	A.G.A.	-
82.	7417	Jayaraj	16	M	1	1	0	2	0	1	R/T	14600	7	A.A.	A.C.A.	-
83.	6942	Jaya	75	F	0	0	0	2	1	0	-	8600	3	-	-	-
84.	7617	Vinitha	16	F	0	1	1	2	0	0	O/S	8300	5	-	A.S.A.	-
85.	7486	Mariyammal	17	F	0	1	1	2	1	1	MASS	9600	4	-	-	-
86.	7862	Shanthi	45	F	0	0	0	2	1	0	P/S	12700	5	A.A.	A.C.A.	-
87.	7603	Shatish	14	M	1	1	0	2	1	1	H	16500	8	A.A.	A.C.A.	-
88.	7974	Gowshik	32	M	1	1	1	2	1	1	R/S	18000	9	IL. PERF	N.A.	-
89.	8000	Bishalu	20	M	1	0	0	2	1	1	P/S	12600	7	A.A.	A.S.A.	D
90.	8106	Priyanka	20	F	0	0	0	2	0	1	O/S	8700	3	-	-	-
91.	8206	Vijayakumari	16	F	0	0	0	2	1	0	R/T	19600	5	A.A.	A.C.A.	-
92.	8242	Alaudin	25	M	1	0	1	2	1	1	R/S	16600	8	A.A.	A.C.A.	W.I.
93.	8296	Paranthaman	35	M	0	1	0	2	1	1	P/S	4300	5	A.A.	N.A.	-
94.	8347	Murugananth	24	M	0	1	0	2	0	0	MASS	12600	5	A.A.	A.S.A.	-
95.	8450	Jayachandar	50	M	0	0	1	2	0	0	O/S	14500	5	A.A.	A.C.A.	W.I.
96.	8602	Satishkumar	32	M	1	1	0	2	0	1		6820	5	A.A.	A.C.A.	-
97.	9004	Shahid nisha	39	M	0	1	0	2	0	0	R/T	12500	5	A.A.	A.C.A.	-
98.	9034	Gandhimathi	55	F	1	0	0	2	0	0	P/S	14300	5	A.C.A.	A.S.A.	RTI
99.	8595	Vijayaramana	12	M	0	1	1	2	1	1	R/S	16500	8	A.A.	A.P.A.	W.I.
100.	9426	Chinnaraj	53	M	0	0	0	2	1	0	R/T	6300	3	-	-	-

INSTITUTIONAL ETHICAL COMMITTEE
GOVT.KILPAUK MEDICAL COLLEGE,
CHENNAI-10
Ref.No.5614/ME-1/Ethics/2013 Dt:04.07.2013
CERTIFICATE OF APPROVAL

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "A Study of validating Alvarado scoring in diagnosis of acute appendicitis" – For Research work submitted by Dr.S.I.MD Sikkander Basha, MS (GS), PG Student, KMC, Chennai-10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

GOVT. KILPAUK MEDICAL COLLEGE
09 OCT 2013
Kilpauk, Chennai-10.

9/10/13.

CHAIRMAN,
Ethical Committee
Govt.Kilpauk Medical College,
Chennai

Validating Alvarado scoring in diagnosing acute appendicitis

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